THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING

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PC MAGAZINE

VOLUME 7 NUMBER 13
JULY 1988

Free TSR: Total Serial Port and Video Control—SETMODE Delivers!

VGA: Don't Settle For Less

PC Labs Tests 9 New Boards

- Scientific Word Processors: Formulas for Success
- Plus: 21 Programmable Comm Packages; 9 Budget ATs
- First Looks: Toshiba T5100 Packs 386 Power For the Road

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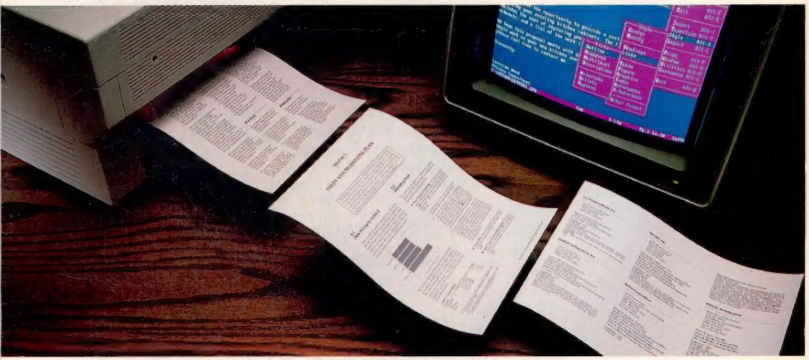

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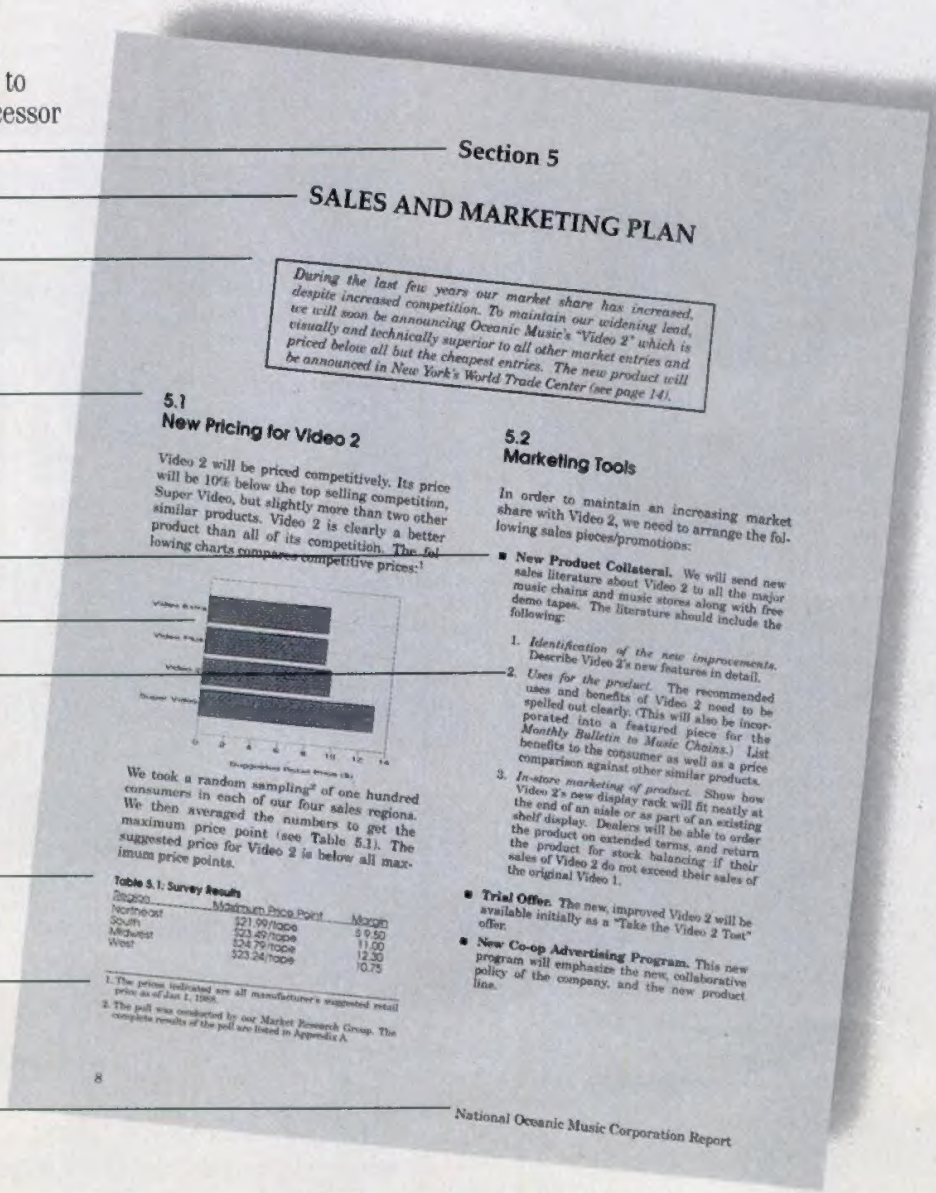

Section 5

SALES AND MARKETING PLAN

During the last few years our market share has increased, despite increased competition. To maintain our widening lead, we will soon be announcing Oceanic Music's "Video 2" which is visually and technically superior to all other market entries and priced below all but the cheapest entries. The new product will be announced in New York's World Trade Center (see page 14).

5.1
New Pricing for Video 2

Video 2 will be priced competitively. Its price will be 10% below the top selling competition, Super Video, but slightly more than two other similar products. Video 2 is clearly a better product than all of its competition. The following charts compares competitive prices:[1]

We took a random sampling[2] of one hundred consumers in each of our four sales regions. We then averaged the numbers to get the maximum price point (see Table 5.1). The suggested price for Video 2 is below all maximum price points.

Table 5.1: Survey Results

Region	Maximum Price Point	Margin
Northeast	$21.99/tape	$ 9.50
South	$23.49/tape	11.00
Midwest	$24.79/tape	12.30
West	$23.24/tape	10.75

1. The prices indicated are all manufacturer's suggested retail price as of Jan 1, 1988.

2. The poll was conducted by our Market Research Group. The complete results of the poll are listed in Appendix A.

5.2
Marketing Tools

In order to maintain an increasing market share with Video 2, we need to arrange the following sales pieces/promotions:

- **New Product Collateral.** We will send new sales literature about Video 2 to all the major music chains and music stores along with free demo tapes. The literature should include the following:

1. *Identification of the new improvements.* Describe Video 2's new features in detail.
2. *Uses for the product.* The recommended uses and benefits of Video 2 need to be spelled out clearly. (This will also be incorporated into a featured piece for the *Monthly Bulletin to Music Chains.*) List benefits to the consumer as well as a price comparison against other similar products.
3. *In-store marketing of product.* Show how Video 2's new display rack will fit neatly at the end of an aisle or as part of an existing shelf display. Dealers will be able to order the product on extended terms, and return the product for stock balancing if their sales of Video 2 do not exceed their sales of the original Video 1.

- **Trial Offer.** The new, improved Video 2 will be available initially as a "Take the Video 2 Test" offer.
- **New Co-op Advertising Program.** This new program will emphasize the new, collaborative policy of the company, and the new product line.

8

National Oceanic Music Corporation Report

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WHAT'S INSIDE

In this issue, *PC Magazine* makes good on a promise Bill Machrone made back in February. A reader had written to suggest that we include more remarks about the concerns of scientists in our regular stories, and Machrone responded that reporting on the advanced features that serve scientists will help all readers make more-informed purchasing decisions. So we thought: Why not conclude our roundup of word processors with a look at new and better ways of working with scientific and technical material?

Two great communicators: PC Labs project leader Frank Mitard and contributing editor M. David Stone.

The 12 programs we review in "Scientific Word Processors: Formulas for Success" simplify the writing and editing of equations both mathematical and chemical—the elements that are vital to technical publishing. Anyone who has worked with the predecessors of these packages will appreciate the gains in usability and functionality within this product category. And anyone who has ever been frustrated trying to use a general-purpose WP to format an occasional equation or two may find the right secondary package among this group.

MAKING WAY FOR VGA Just as scientific word processors are achieving maturity and moving into the mainstream of desktop computing, VGA display adapters are developing the potential of making any office a room with a colorful view. In our cover story, contributing editor Winn L. Rosch reviews nine low-cost register-compatible VGA boards that take the next step in bringing the VGA standard to PCs, XTs, and ATs. Says Rosch, "Now the glass doesn't have to be greener on the other side of the office where that other guy has a new PS/2 and VGA technology—and you don't." Rosch's point: VGA is a standard PC users no longer can afford to envy.

Finally, we look at 21 communications programs that feature powerful script languages. One of the challenges of working on this story, according to contributing editor M. David Stone and PC Labs project leader Frank Mitard, was settling on definitions for Xmodem and Ymodem protocols and their variants, which are given different names by two camps of communications experts. Says Stone, "If we simply used the protocol labels the vendors use, it would be like comparing apples and oranges and calling them peaches." After long conversations with Chuck Forsberg—the creator of Ymodem—and with software vendors, Stone and Mitard decided to adopt conventions that side with neither school. Will that end the debate or just fuel it anew? We'll let you know.

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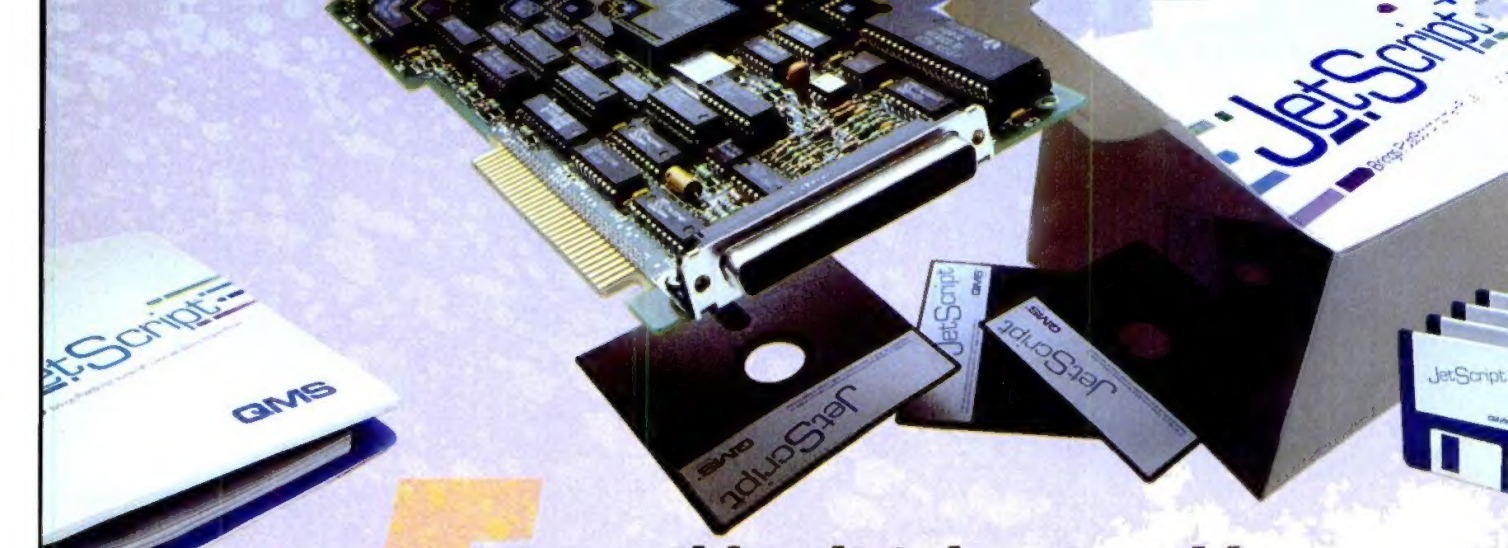

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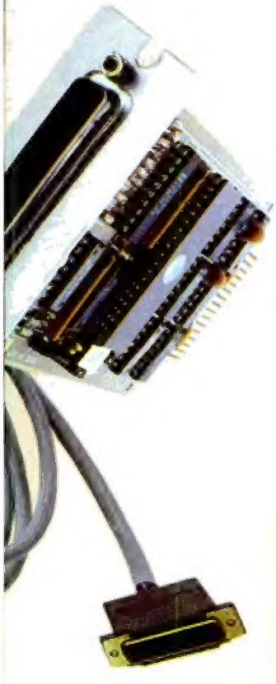

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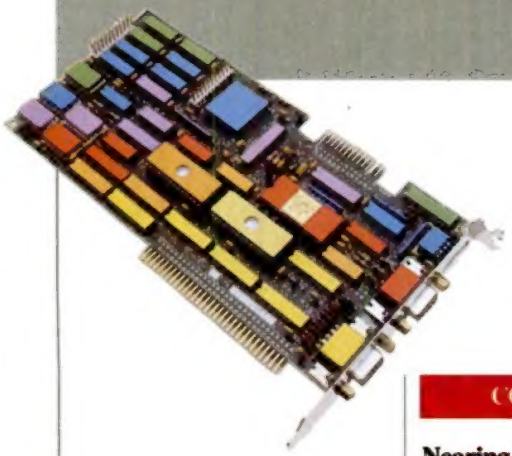


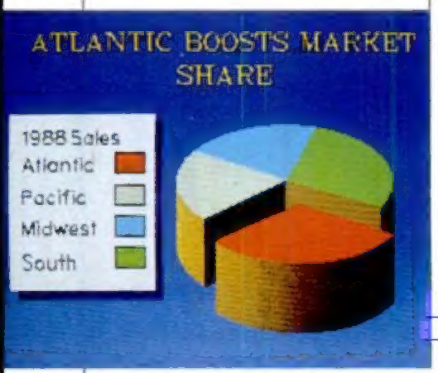
PC MAGAZINE

COVER STORY

Nearing Perfection: VGA Boards Enter the Mainstream

Winn L. Rosch/ Transform your PC's screen from dull to dazzling. This second wave of VGA-compatible display adapters from Everex Systems, Intelligent Data Systems, Orchid Technology, Paradise Systems, Sigma Designs, Tatung Co. of America, Taxan USA, Tecmar, and Video Seven will make your PC's color and resolution rival a

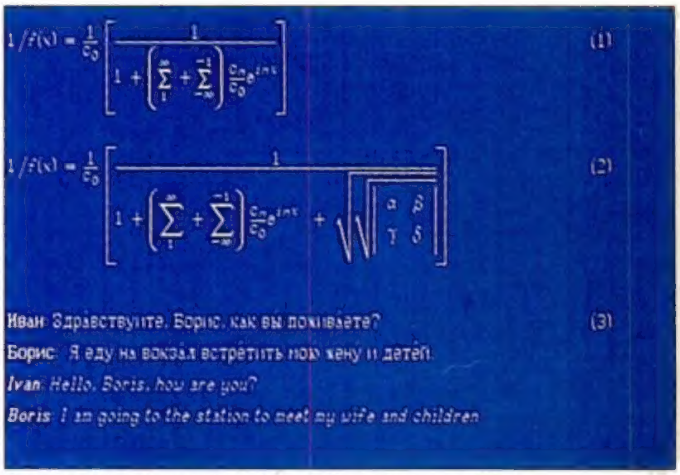
PS/2's 93
Features Table 95
Performance Tests 102



VGA boards sharpen the resolution standard, page 93.

Nine ATs in competition, page 207.

FEATURES



Scientific WPs blend technical symbols and text, page 251.

COMMUNICATIONS

PC Communications Comes of Age

M. David Stone/ Automate your communications or build new features into your system with the new generation of communications software. Our reviewers examine 21 script language programs that offer the kind of versatility you'd expect to see only in a

programming language 127
Features Table 140
Performance Tests 151

COMPUTERS

The Niche Factor: Nine ATs Compete for Market Share

Donald P. Willmott/ Some slash prices and others add features, but all nine of these AT compatibles are looking for ways to capture a piece of the competitive AT

marketplace 207
Features Table 208
Performance Tests 238

WORD PROCESSING

Scientific Word Processors: Formulas for Success

Jim Seymour/ Simplify the integration of text and technical character sets with one of the 12 scientific WPs reviewed here. Contributing editor Jim Seymour traces the evolution of these word processors from Donald Knuth's complicated TEX to the more-sophisticated products available

today 251
Features Table 266
Performance Tests 300

EDITORIAL PRODUCT INDEX

The complete listing of products reviewed in this issue, plus a quick reference to utilities, programs, and tips in

the Productivity section ... 513

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Roberto Brosan

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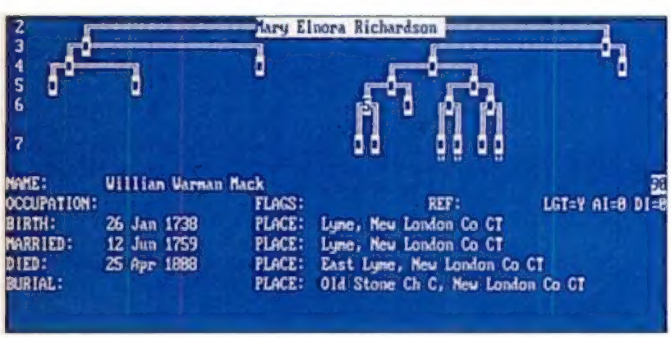
FIRST LOOKS

Hands On:

- The Toshiba T5100 squeezes 386 performance and 2MB RAM into a laptop chassis
- *IZE*, from Persoft, adds new twist to managing free-form information
- Emerald Bay's *Data Base Administrator* and *Eagle*
- An inexpensive 20-MHz tower from Northgate
- Ashton-Tate's *Draw Applause* enters the presentation graphics arena
- *The Image Printing Utilities* teach 9-pin dot matrix printers new tricks
- *Tree86* hard disk organizer, excellent mouse support
- Super Cartridge I replaces 23 HP cartridges
- *Dan Bricklin's Demo II Program*
- CuRAM 80-8: memory for the Model 80 33

AFTER HOURS

- *Campaign Promises* lets you make a run for the presidency
- Three genealogy programs for tracing your family tree
- *Bob and Jean Anderson's Computer Stretches*, the PC's answer to Jane Fonda and Richard Simmons.....524



Genealogy programs track your past, in After Hours, page 524.

PRODUCTIVITY

PC LAB NOTES
Instant Speedup for Your PC
Brian K. Roemmele/ A simple software technique can boost your computer's performance. Learn how postponing the refresh cycle squeezes extra speed from memory 331

UTILITIES
Communications and Video Setup with SETMODE FREE PROGRAM
Tom Kihlken/ Presenting a resident utility that makes the tricky job of setting your video mode and communications parameters a lot faster and simpler..... 351

PC MAGAZINE HELP FILE 337

ENVIRONMENTS
Introducing the OS/2 Presentation Manager
Charles Petzold/ A first look at OS/2 1.1, whose graphics-based interface will make software easier to use 379

POWER PROGRAMMING
Keeping Filenames Fully Qualified
Ray Duncan/ Storing incomplete filenames in full drive-and-path form 397

SPREADSHEET CLINIC
Douglas Cobb and Steven Cobb/ Instantly editing records using an undocumented Query key function 413

USER-TO-USER
Salvatore P. Ricciardi/ Automating program development using batch files; important warnings about using the DOS APPEND command with BASICA 419

POWER USER
Craig L. Stark/ Identifying the current drive and subdirectory in *dBASE III Plus* and *Clipper*; creating *WordPerfect* concordance files 427

LANGUAGES
Robert L. Hummel/ A simple program to merge C code with the compiler's assembler output; creating custom character fonts in BASIC.. 435

PC TUTOR
Robert L. Hummel/ Understanding the bad sectors on your hard disk; running monochrome and color monitors simultaneously .. 447

CONNECTIVITY CLINIC
Frank J. Derfler, Jr./ Finding an ARCnet station address with BASIC and an Ethernet address using C; terminating printer spooling in commercial programs automatically ... 453

VIEWPOINTS

LETTERS TO PC MAGAZINE.....15

PC ADVISOR
Mitt Jones/ Separating keyboard and monitor from system unit; QMS JetScript adds PostScript capability to your HP LaserJet Series II; an AT&T-sponsored bulletin board for AT&T 6300 users.....27

BILL MACHRONE
In Your (Inter)Face 65

JOHN C. DVORAK
Confessions of a Power User.....71
Inside Track.....73

JIM SEYMOUR
386 PCs: Redefining the Workstation.....77

STEPHEN MANES
Extension Course: Filenames for the Future.....85

Direct Marketing Connection.....461
Reader Service Card..515
Advertisers' Product Index.....517
Index to Advertisers...523

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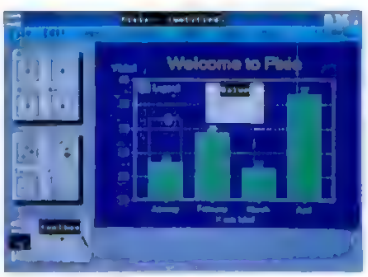
Pixie is Zenographics' newest winner. It connects beautifully with our flagship product **Mirage** – the PC-based tool of choice for graphics professionals. Through Mirage, Pixie gains access to the best and most complete output device drivers, and to the artistic expertise of thousands of Mirage power-users worldwide.

	Pixie	Harvard Graphics	Freelance Plus
Graphical user interface?	Yes (MS Windows)	No	No
User interface technique	Direct manipulation	Fill-in forms	Fill-in forms
Editing preserved if chart changes?	Yes	No	No
Screen Fonts	Windows, Bitstream, Mirage	Helv, 1 hardware font	Stick
Maximum colors per image	16 million (Windows limit)	16	12
Compatible with professional systems?	Yes (Mirage)	No	No
Price	$195	$495	$495



Our form

Their form

Pixie

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Zenographics

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"The Breakthru 286 performed flawlessly with every application we handed it, including copy-protected programs and nine memory-resident utilities at once."
Stephen Manes, PC Magazine

"...the Breakthru 286 was the card of choice."
PC BusinessSoftwareview **(Rated #1)**

"...Breakthru 286 is a good value and a quality product backed by effective support."
Dan A. Griffin
The Newsletter of the AutoCAD User's Group

"The PCSG Breakthru 286 achieved the best performance results of the caching boards tested."
Ted Mirecki, PC Tech Journal **(Rated #1)**

"The 12-MHz Breakthru 286-12 speedup board is the fastest of those tested, but not the most expensive. On a dollar per-horsepower basis, it could be called the cheapest boost available for an XT."
Mark Welch, InfoWorld **(Rated #1)**

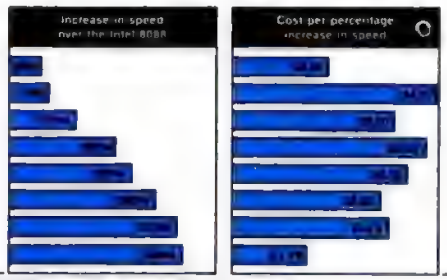
Think You Need an AT?

Make Your IBM PC Faster Than an AT in Just 5 Minutes!

Accelerator Cards: Speed and Value

Speed figures are consolidated results from 10 tests of CPU performance (See Accelerator Boards Special Report, December 1, 1986.)

☐ Microspeed Fast 88	$149
☐ Microsoft Mach 10	$395
☐ Univation Dream Board	$512
☐ Orchid Turbo EGA	$945
☐ ST&D Standard 286	$995
☐ Classic Speedpack	$995
☐ Orchid PC-Turbo 286e	$1,195
☐ **Breakthru 286-12**	**$595**



REPRINTED FROM INFOWORLD, APRIL 27, 1987

Breakthru 286-8MHz-$395
Breakthru 286-12MHz-$595

LIGHTNING™—FREE with Breakthru speedup hardware—$89.95 purchased separately

We are excited about our three speedup products. You probably know about our Lightning disk access speedup software that was awarded PC Magazine's Best of 1986 award (see box). After the smashing success of Lightning, in late '86, we guaranteed the Breakthru 286 board to be literally the most advanced, fastest, most feature-rich board available. The runaway success it has enjoyed truly proved that assertion. Now we go ourselves one better with the Breakthru 286-12. This new board has the clock speed cranked up from 8 to 12 MHz for speeds up to 10.2 times faster than an IBM PC. It is 50% faster than an 8MHz IBM AT, and up to a whopping 1,000% faster than a regular PC.

HERE'S WHY THESE TWO BOARDS ARE SO SPECIAL.

First, they install so easily. A half-slot card means you don't even have to give up a full slot. What's more, unlike competing products it works in the Compaq Portable and most clones. Easy diagrams show how you just place the card in an open slot, remove the original processor and connect a single cable. There is no software required. From that moment you are running faster than an AT.

Second, they are advanced. The BREAKTHRU 286 replaces the CPU of the PC or XT with an 80286 microprocessor that is faster than the one found in the AT. Has a 80287 math coprocessor slot for numeric intensive applications. A 16K cache memory provides zero-wait-access to the most recently used code and data. Speed switching software allows you to drop back to a lower speed on the fly for timing sensitive applications.

Third, you have full compatibility. All existing system RAM, hardware, and peripheral cards can be used without software modification. Our boards operate with LAN and mainframe communication products and conform to the Expanded Memory Specification (EMS). Software compatibility is virtually universal.

Faster and smarter than an AT - PCSG guarantees it.

Fourth, these are the best. There are several other boards on the speedup market. We at PCSG have compared them all, but there simply is no comparison. Many cards offer only a marginal speedup in spite of their claims and others are just poorly engineered.

We are really excited about these products. PCSG makes the unabashed statement that the BREAKTHRU 286 card represents more advanced technology than boards by Orchid, Quadram, P.C. Technologies, Phoenix...we could go on. Breakthru 286 is undisputedly the turbo board with the biggest bang for the buck. And we include FREE the $89.95 acclaimed Lightning software. Call today with your credit card or COD instructions and we will ship your card the very next day.

But, no speedup board cuts disk access time in half

LIGHTNING™

software can - $89.95 or FREE w/Breakthru

"Lightning is almost mandatory...." -
Steve Manes, PC Magazine
Best of 86 review

Loads with the DOS - always ready as a background program to accelerate disk access. You do nothing - everything is automatic. Programs that frequently access the disk (hard or floppy) are made instantly up to 2 to 4 times faster. Uses a principle greatly enhanced from mainframe technology called caching. Fully exploits Above Board memory.

LIGHTNING is the standard against which all our competition measures itself because we achieve universal compatibility with other software. Data is never lost. Order ***LIGHTNING*** separately or get it free with your Breakthru 286 board.

PC MAGAZINE EDITORS' CHOICE BEST 1986

Think Again.

DON'T TAKE OUR WORD FOR IT. USE EITHER BREAKTHRU 286 SPEEDUP BOARD FOR 60 DAYS. IF YOU ARE NOT TOTALLY SATISFIED SIMPLY RETURN IT FOR A FULL REFUND.

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Exceptional 3-D Spreadsheet

Lucid 3-D™ is a runaway success

Don't take our word for it. Use Lucid 3-D for 60 days. Return it for a full refund if not completely satisfied. Plus, instead of the $199 list price, an introductory spread-the-word price of $149.

Lucid 3-D is priced to sell at $199, but we want thousands of people using Lucid everyday, all over the world. We invite you to be a part of that group. The reason we are offering Lucid for only $149, on a sixty day return for a full refund, is simple. Preliminary user testing of the product produces the same results over and over. People tell us they would never work without Lucid 3-D again. Even folks continuing to work with 1-2-3.

Memory Resident

That's because the idea of a memory resident spreadsheet makes sense, one that you can pop-up instantly while working in your word processor or any other program. Lucid lets you cut anything on the screen and paste it right into Lucid, or cut anything from a Lucid worksheet and paste into the application below. You can even run Lucid on top of 1-2-3 if you like, and cut and paste information from one to the other, including formulas.

Lucid 3-D was developed over the past two years with countless, exhaustive hours of planning and programming to produce something spectacular. This is a product that works the way we dreamed a spreadsheet would function. Everyone who has seen it says things like, "*Lucid 3-D is how software of the 1990's will look and perform*", or even more to the point "*This is the way I thought a computer should work*". You'll see. Lucid is exciting.

FIG. 2 Here we are, instantly. Notice the lower left corner showing we are on level 2. You can go down or up. (See next page)

FIG. 1 Let's get the detail on those ad costs. Just move the widebar to that cell and press one key (grey +).

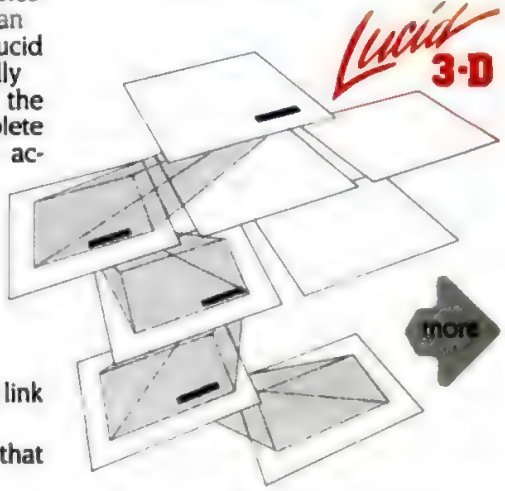
way. Users say "*It is so intuitive that I really don't need a manual.*" That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said that, "*If there ever was an interface idea so good it ought to be stolen and widely used, this is it.*"

What he was talking about is a new menu approach that follows a simple design concept: it is easier to recognize than it is to remember. As choices are made on a menu that take you to lower levels you always can see exactly where you came from and where you are going. The complete menu path is always visible. You cannot get lost several levels down. This means you never have to remember a command, you just flow right to it.

What Makes it so Special

In the screen examples you can see Lucid is really multi-dimensional. Any cell of the spreadsheet can contain a complete other spreadsheet that you can access with a single keystroke. It is as simple as the pictures show. And you don't have to write formulas to do that. All you do is go look at the other file, navigating through easy, point and shoot directories. When you come back up (with one key) the link is made automatically for you.

Everything about Lucid works that



1-800-544-4699

Any cell can contain a complete other spreadsheet that you can access with a single key.

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 400 topics and select the one you want.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet

FIG. 3 We want more detail, so let's go to Newspapers. Just press the Grey + Key

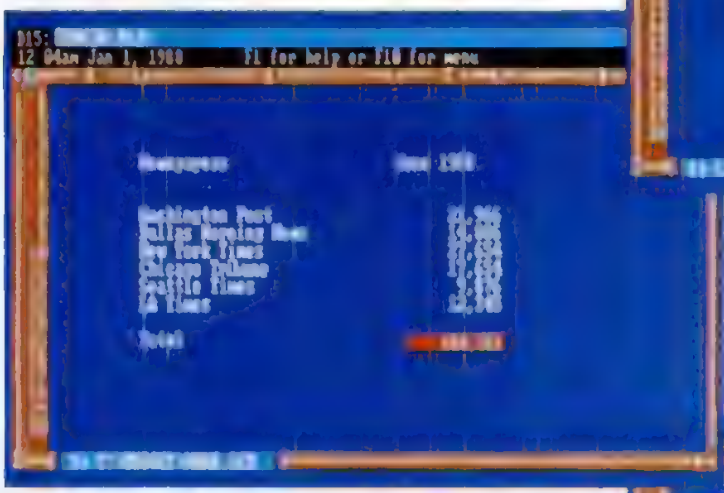


FIG. 4. Now, instantly we are on level 3. Each level is a different spreadsheet. You could now move to the New York Times and see the detail on that figure. There is no limit to the levels you can go. Move right down to transaction level if you like.

> "The best idea I've seen for a spreadsheet in years."
>
> Jim Seymour, Columnist, PC Magazine, PC Week

Fig. 5. Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many as 3-D levels as you like. No one else can do that.

Speed

Lucid 3-D is truly revolutionary. It is fast, fast, fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing screen are completed. Other calculations you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about.

Lucid Learns

Lucid 3-D also lets you teach it any combinations of keystrokes so that involved sequences can be done with single keys. Plus more than just remembering keystrokes, Lucid allows you to create Macros with loops, procedures and conditional branching amazingly all done automatically with simple menus. You can create your own menus that show the new features you have taught it. Another great feature is you can make your custom menus work like Lucid where one choice can take you down a level to a whole new set of choices. What's nice is that they will work from one spreadsheet to another.

Mouseability

Lucid 3-D was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those you've seen with 1-2-3.

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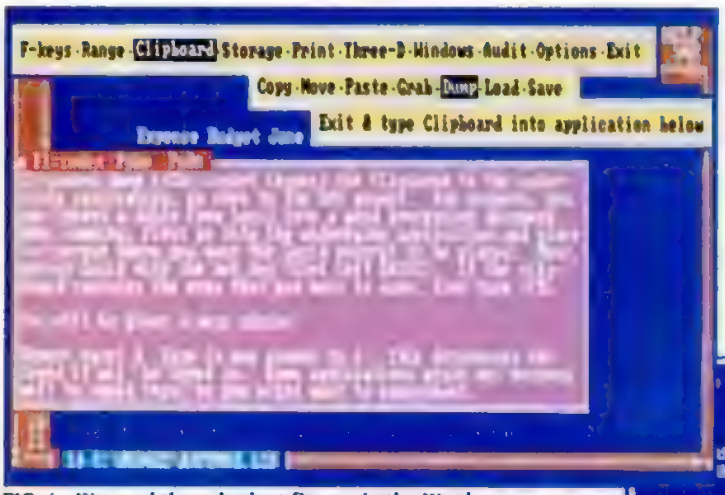

FIG. 6 We need those budget figures in the Word Perfect letter we are writing. Clipboard Dump does it right now.

FIG. 7 Here it is right in Word Perfect (or any word processor) just like you typed it. You can go the other way just as easily.

A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often.

It really permits that feeling of becoming one with your work. Lucid 3-D has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

Audit

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid offers five audit displays and printouts.

Masterwork

We could go on at great length about all the features and innovations in Lucid, but Lucid is more than a bag of features. What is most important is the pride and craftsmanship that went into its creation. It is a masterwork. The overall feel is tight and polished. In fact, Paul Somerson, executive editor of PC *Magazine*, used one word to describe it, "*Slick*".

PCSG has built a reputation as a development laboratory producing products that you know are excellent. In 1983 PCSG dominated the Model 100 laptop market with ROM based software that every reviewer rated as excellent. In 1985 we produced ***LIGHTNING*** the pioneer and award winning Disk speed up software. In 1986 we developed the ***BREAKthru 286*** accelerator board that blew everything else out of the water, and later we topped ourselves with the Breakthru 12. Now in 1987 those who have worked with Lucid 3-D tell us "*you have done it again. This is software everyone should have.*"

Even if you don't plan to abandon 1-2-3, Lucid makes sense. Files are converted between them with ease so there's not an interoffice compatibility problem. This means you can have the power and fun of Lucid 3-D without having to upset your present systems.

We are excited about Lucid 3-D. But don't take our word for it, take us up on our 60 day offer. Call us on our order line number and we will ship your order the very next day. This $149 offer will end as soon as our dealer network is fully stocked. But in the mean time we invite you to try Lucid as part of our "spread the news" campaign. Just pick up the phone and call us. We accept all major credit cards or you can order COD.

Exceptional spreadsheet for the IBM PC, PS and Compatibles.

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Lucid 3-D

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CIRCLE 483 ON READER SERVICE CARD

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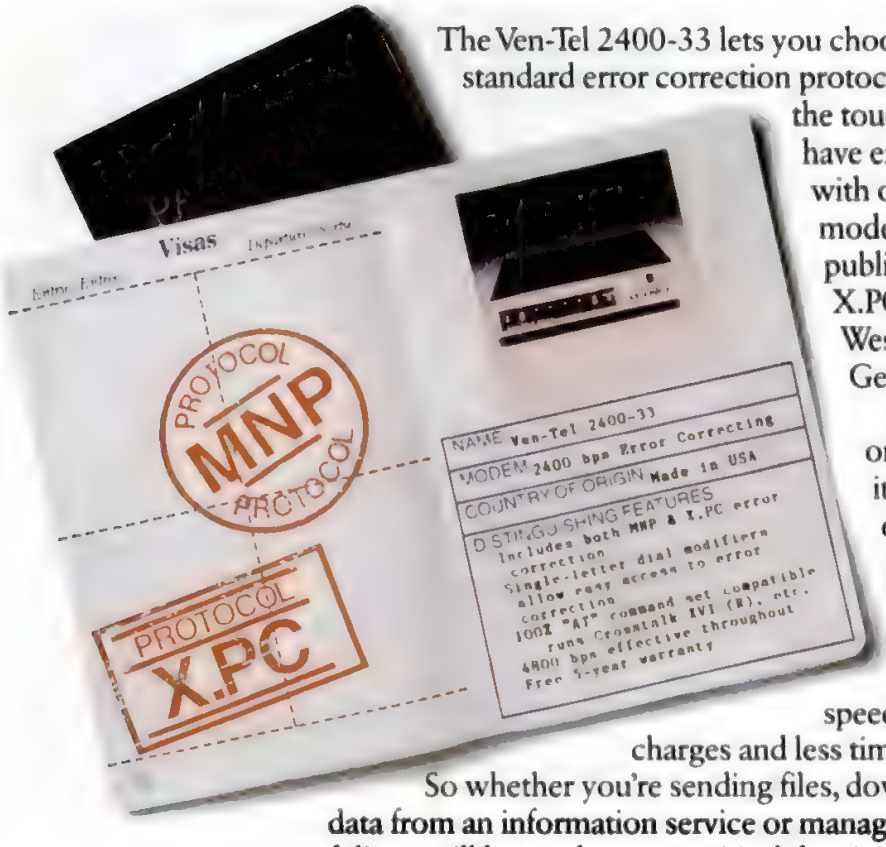
The error correcting modem that ensures safe passage for your data– no matter where it's traveling.



The Ven-Tel 2400-33 lets you choose between the two standard error correction protocols (X.PC and MNP) at the touch of a key. So you'll have error free connections with over 350,000 MNP modems *and* with major public data networks using X.PC–like Tymnet, MCI, Western Union and GE Geisco.

And the 2400-33 not only protects your data, it's faster than *any* non-error corrected modem. MNP Level 5 data compression can double your throughput up to 4800 bps—and higher speeds mean reduced phone charges and less time spent transmitting.

So whether you're sending files, downloading expensive data from an information service or managing your personal portfolio, you'll know that your critical data is 100% correct.

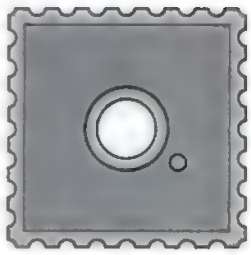
The Ven-Tel 2400-33. The only modem that guarantees your data a flawless trip…no matter where it's traveling.

Ven-Tel
Modems

Our free booklet, "How To Select The Correct Modem," contains specific information about the 2400-33 and our full line of modems. To request your copy, call 800-538-5121.

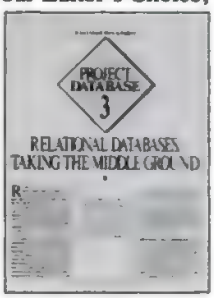
CIRCLE 364 ON READER SERVICE CARD

LETTERS TO PC MAGAZINE



OFF-KEY AND OUT OF TUNE

Your article on relational databases ("Relational Databases: Taking the Middle Ground," *PC Magazine*, April 26, 1988) has left me aghast. Your Editor's Choice, *PowerBase*, gets the nod with *no* sort facility?



Everything we do at the Virginia Living Museum (keeping track of donors, members, and so on) is sorted by ZIP code, last name, or other criteria. I fail to understand how you could have been so unattuned to what most of us do with the files in our databases.

James R. Rollings III
Director of Development
Virginia Living Museum
Newport News, Virginia

Mr. Rollings is apparently unattuned to the risks of sorting. Programs that accomplish sorts by physically swapping records can compromise data integrity if your system goes down during the sort. The more elegant approach to reordering your records—the one that PowerBase *takes—is indexing. Using this feature,* PowerBase *completed the PC Labs sort tests with no trouble at all (see the April 26, 1988, issue, page 174).*—Ed.

NUTS OVER NUTSHELL

Mike Falkner's favorable review of *Nutshell Plus* ("Relational Databases: Taking the Middle Ground," *PC Magazine*, April 26, 1988) nicely summarized the program's features, but the reviewer missed an important point. *Nutshell Plus* places no limits on text field size. For those of us who store, sort, and retrieve lengthy descriptive or historical notes and similar text-laden records, that feature is indispensable. As a satisfied user of the program, I was disappointed you had not pointed out *Nutshell Plus*'s unusual, almost unique talents in this regard.

Marvin Brienes
Woodland, California

UTILITY TO THE RESCUE!

I just want to thank you for the software on your utilities disk. I have put several of these programs to good use. In fact, LPTPORT.COM solved a major problem for me when I could not get one of my programs to print properly.

Although I had a second parallel printer port available on my Intel AboveBoard card, I could not figure out how to address it as LPT1, which is the only port this program can use. LPTPORT to the rescue! I switched my printer cable to the AboveBoard parallel outlet and loaded LPTPORT.COM in the AUTOEXEC.BAT file, and everything worked! Your program saved me many dollars and hours of headaches.

James E. Reid
Haverhill, Massachusetts

SIFTING THROUGH SEXISM

With all the documented evidence concerning the destructive effects of sexist language, it is hard to believe that a publication as evolved as yours still indulges in its use. Yet every month, blended in with your well-researched articles, priceless reviews, and sharp commentary are countless sexist terms and pronouns—almost all of which could be easily rectified.

A new editorial policy in this area could help the finest Independent Guide to IBM-Standard Personal Computing stop contributing to this pervasive form of sexism!

William Detjen
Winooski, Vermont

IBM: ITS OWN WORST ENEMY

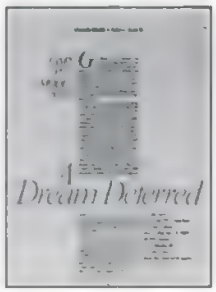
I agree 100 percent with Robert L. Hummel's definition in his PC Tutor column on OS/2 (*PC Magazine*, April 12, 1988). The number-one problem that plagues the IBM PC world is—IBM!

Sadly, IBM doesn't see it that way and will likely ignore your suggestions.

Derek Hamilton
Toronto, Ontario
Canada

SPEED LIMITS

I was pleased with the open-mindedness Winn L. Rosch exhibited in his review "IBM's PS/2 Model 80-111: A Dream Deferred," *PC Magazine*, April 26, 1988). It was refreshing to see that speed, power, and speed were not his only considerations. I cannot think of any one computer that is better in every way than another. When *any* two computers are compared head-to-head, there will always be some little area where even a heavy underdog will excel.



Jack E. McCoy
Deep Run, North Carolina

It was with great interest that I read your article "IBM's PS/2 Model 80-111: A Dream Deferred." I wasn't surprised to once again see unfair criticism of IBM for not blazing the trail in speed.

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- [5] **COMM 4a,b,c,d,e**—(5 disks) Join the world of sysops with RBBS Bulletin Board System 14.1D.
- [2] **DATABASE 1a,b**—(2 disks) File Express 3.8 menu driven general purpose database manager.
- ☐ **EDUCATION 1**—Interactive DOS tutorial for new PC users. Makes learning DOS painless.
- [2] **FINANCE 1a,b**—(2 disks) PC Accountant 2.0 personal bookkeeping and finance management.
- ☐ **GAMES 1**—3-D Pacman, Kong, Spacewar, Janit-Joe, futuristic Flightmare and more. Color required.
- ☐ **GAMES 2**—Qubert, Pango, Centipede, dungeons and dragons style Zoarre, etc. Color req.
- ☐ **GAMES 3**—Blackjack with customizable rules, Armchair Quarterback (you call plays), and more.
- ☐ **GAMES 4**—Star Trek, the Castle adventure game, and the original Colossal Caves Adventure.
- ☐ **GAMES 5**—The Hack adventure game from the universities. Like Rogue, only much richer.
- ☐ **GAMES 6**—Pinball, Othello, Dragons, Sopwith (fly a Sopwith Camel) and more. Color required.
- [2] **INFO 1a,b**—(2 disks) Cooking recipes database with keyword/ingredient retrieval. Add your own.
- [2] **MUSIC 2a,b**—(2 disks) PianoMan 3.0 polyphonic music recording and playback program.
- ☐ **ORGANIZER 1**—DeskTeam, a Sidekick clone, and the Judy personal calendar program.
- ☐ **PRINTER 1**—Resident print control and font utility, intelligent spooler, banner maker, and more.
- ☐ **SIMULATION 1**—Maze making program, MIT's Life simulation, starfields, etc. Color graphics req.
- ☐ **UTILITIES 1**—A collection of invaluable general purpose DOS utilities. An absolute must for all.
- ☐ **UTILITIES 2**—More invaluable DOS utilities including screen burnout, ram disk, and more.
- ☐ **UTILITIES 3**—A comprehensive set of debugging and diagnostic utilities for monitoring your computer.

PC 7/88

NEW RELEASES/UPDATES

- ☐ **BUSINESS 2**—Expressgraph business graphics. Chart your data and find trends. Color graphics req.
- [2] **CAD 1a,b**—(2 disks) Fingerpaint 1.2 advanced painting and Altamira object oriented design. Color.
- [2] **CAD 2a,b**—(2 disks) DanCad3d, an advanced 2D/3D drafting program w/animation. 640K, color.
- [2] **COMM 2a,b**—(2 disks) Procomm 2.42, an excellent modem program with terminal emulation.
- ☐ **EDUCATION 3**—PC-Fastype 1.20 typing tutor, ideal for beginners and advanced students alike.
- [2] **FINANCES 3a,b**—(2 disks) Express Calc 3.12, a powerful and user friendly spreadsheet program.
- ☐ **GAMES 8**—Striker helicopter attack and Risk, the game of world domination. Color required.
- ☐ **GAMES 12**—Backgammon (play the computer) and Wheel of Fortune based on the gameshow.
- ☐ **GRAPHICS 1**—Record and play back screen images! Excellent for demo, etc. Color required.
- [3] **GRAPHICS 2a,b,c**—(3 disks) An excellent 3-D surface modelling and shading program. Color.
- [2] **INFO 2a,b**—(2 disks) Zip-Phone, national areacode/prefix to zip-code cross reference.
- [2] **LANGUAGE 3a,b**—(2 disks) The A86 3.09 macro assembler and debugger for 8088/86/286s.
- [2] **SHELL 4a,b**—(2 disks) Automenu and HDM II 4.04 hard disk prog. for custom full-screen menus.
- ☐ **UTILITIES 5**—Hard disk utilities for verifying, formatting, parking and optimizing your disk drives.
- ☐ **UTILITIES 6**—Advanced utilities including Mark/Release (remove resident progs w/o reboot!)
- ☐ **UTILITIES 7**—More advanced utilities including Masterkey (undeletes files from hard disks).
- [2] **WORD 1a,b**—(2 disks) PC Write 2.71, a powerful word processing system w/spell checker, laser supt.

Most software listed is shareware or user-supported.

3.5" format add $1 disk. 125 page directory, add $2

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CIRCLE 302 ON READER SERVICE CARD

■ LETTERS

IBM has never tried to "push the envelope" of computing power by running processors at speeds greater than they were designed for, or by using hard disks with access times faster than drives that had 2 to 3 years of reliability data under their belt, or by implementing major changes that enhanced speed while jeopardizing future compatibility.

I have to wonder what you're going to tell your readers if future developments should prove IBM's decision to be ingenious. The majority will have purchased Compaq 386 computers for their downward compatibility instead of the IBM 386 for its future potential.

James B. Stack
Whitefish, Montana

DEAD LOBSTER REINCARNATION

In Bill Machrone's column "Tough Times at the Market" (*PC Magazine*, April 26, 1988), he wonders, "What do you do with those dead lobsters at the bottom of the tank, the 8088-based machines?"

A possible solution would be to donate those "lobsters" to a charitable organization. I'm sure that either the organization itself or the people it supports could use a spare computer or two (even if it is quasi-obsolete).

Or you could try giving the computers to community schools. Of course, the donation should be tax deductible. In any case, it's a win-win solution.

David A. Lessnau
Fairfax, Virginia

A SIMPLE CHOICE

It was great to see *Q-Pro 4* get a fair review by someone who recognized it for what it is: a powerful programmers' programming language ("Programmable Databases: dBASE and Its Challengers," *PC Magazine*, May 17, 1988).

However, it seems unfair to compare *Q-Pro 4* with *dBASE III* or *R:base*, because like COBOL, BASIC, and C, *Q-Pro 4* is a programmers' language. Q-N-E International used to be known as Quick and Easy, and *Q-Pro 4* users referred to the language as Quick and Easy. Why anyone would want to write and develop in C when they can work in *Q-Pro 4*, translate the programs directly into C, and then compile them is inconceivable. Next time you review programming languages, try stacking them up against *Q-Pro 4* coupled with QE and Q2C, and think about which offers software developers the real choices.

Thomas T. Keating
President
Solutions Software
Cherry Hill, New Jersey

VIDEO VENGEANCE

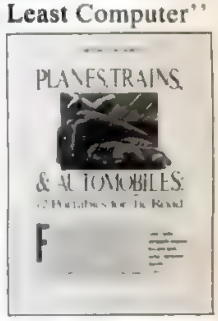
The What's Inside column in the April 26, 1988, issue told of the heroic efforts of your author Mike Falkner, who used his camcorder to capture a momentous screen event on *film*. I would like to point out to you that camcorders, like all video cameras, record their images on *videotape*. Anyone who has ever tried loading his film into a camcorder could probably explain this to you.

Oh well, maybe some video magazine has a Communiqués column I can send that article to.

J. C. Turner
Cedar Falls, Iowa

THE TORTOISE AND THE HARE

As Jim Seymour alluded in the sidebar "The Quest for the Least Computer" ("Planes, Trains, and Automobiles: 12 Portables for the Road," *PC Magazine*, March 29, 1988), the Toshiba T1000 may be a little slower than some, but it offers mouth-watering practicality and functionality, especially when combined with *Framework II* in hard RAM. I have found the resultant 6½ pounds of computing power simply and truly unbeatable! And I've been looking for a long time . . . .



Lt. Col. K. D. Bremer
Austin, Texas

TURBO TURMOIL

Your review of 386 turbo boards ("The Transformers: 386-based Turbo Boards for XTs," *PC Magazine*, April 12, 1988) was more a compilation of observed features than a thoughtful and comparative analysis of performance from a user's

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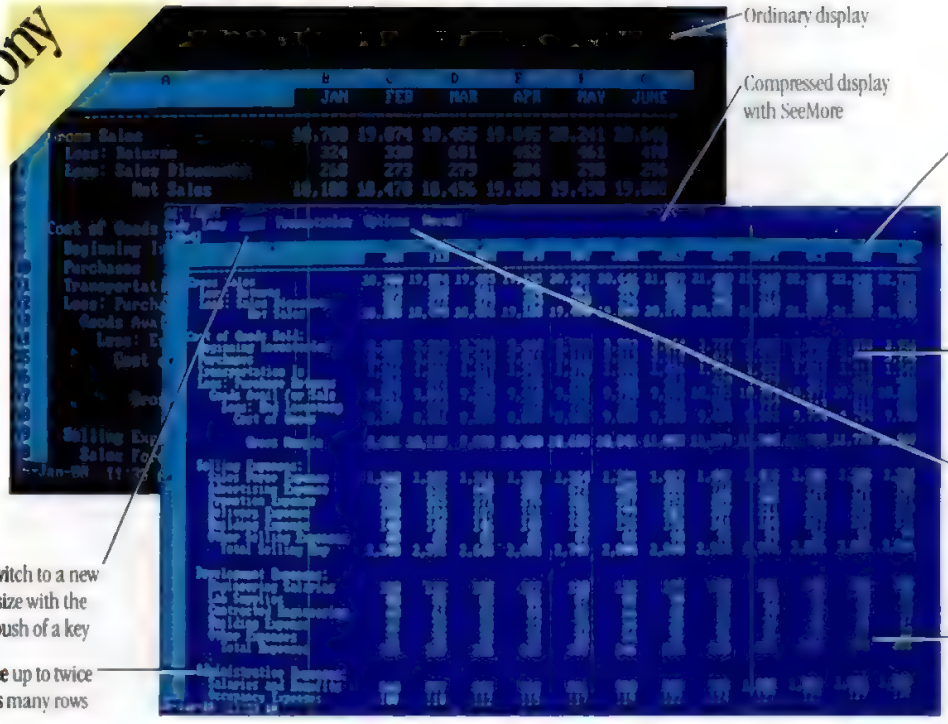

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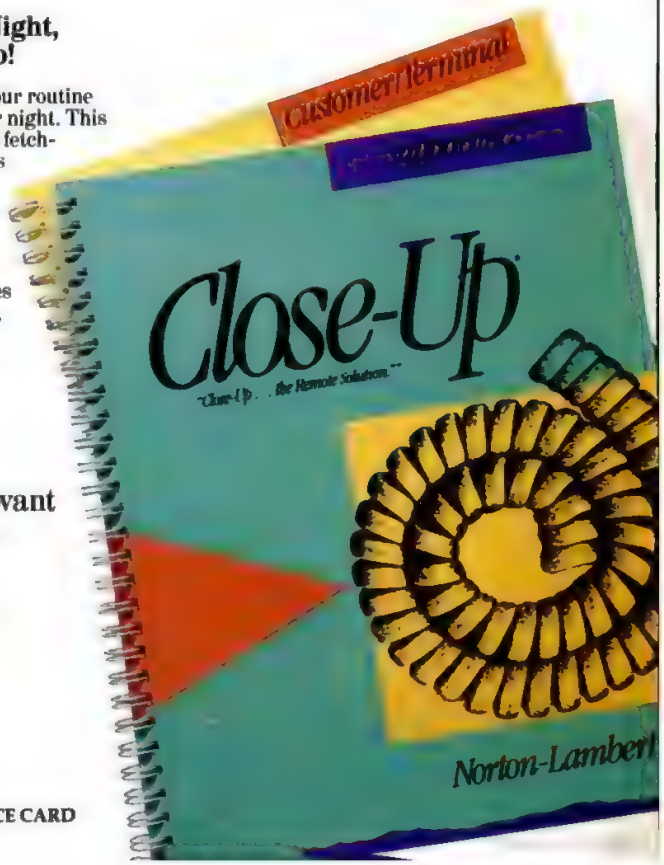

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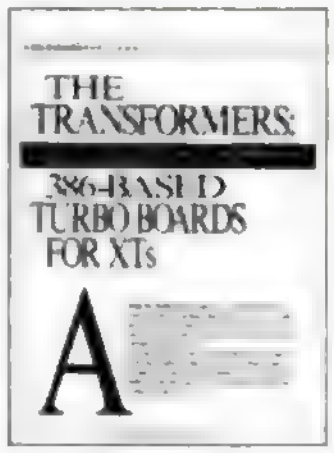
■ LETTERS

point of view. Winn L. Rosch seemed unaware of (or uninterested in) the accompanying benchmark-test comparisons, leaving me somewhat confused about the exact meaning of the results.



The benchmark tests compared the three PC turbo boards with an IBM PC AT rather than with a PC-XT, which was the computer being upgraded. The benchmark tests and discussion also overlooked the existence of high-speed 286 turbo boards, which might have favorable ratios of cost per additional megahertz of speed (and which also run OS/2 now).

The statement that the Inboard 386/PC is limited to "about 80 percent of the calculating throughput" of the 16-MHz Compaq is confusing. Does this mean an effective rating of 12.5 MHz?

The rather important issue of EMS support was only briefly mentioned because of a quirk in the Quad386XT. Lastly, the fact files and review were not sufficiently specific regarding the potentially expensive details such as how much memory is supplied, whether unpopulated boards are available, and the cost of additional cables or any of the other accessories that may be needed.

Al Field
San Diego, California

Actually, features, not performance, distinguish 80386 turbo boards from 80286 products in unenhanced computers. As noted in the story, the additional operating modes and improved memory handling of the 80386 make it the best choice for multitasking.

Throughput and not megahertz is the major issue with the turbos because they are limited in I/O performance by the slow PC bus. Benchmark-test numbers alone will not reveal this shortcoming, a point addressed in the story proper.
—Winn L. Rosch

In Winn L. Rosch's article "The Transformers: 386-based Turbo Boards for XTs," he states that "the Inboard is incompatible with early model PCs with 64K system board RAM."

I own an Intel Inboard 386/PC, and it is functioning properly in my IBM 64K PC. What may have been overlooked is that the successful installation of the Inboard in the older PCs may require the upgraded ROM BIOS that was offered by IBM several years ago.

Overall, I am impressed with how well the Inboard 386 works and how easily it was installed in my PC.

Peter M. Hayes
Durham, Connecticut

Mr. Hayes is correct that the 80386 turbos may work in early PCs, providing that the computers have been upgraded with a new BIOS ROM. Because the upgrade ROM is no longer available from IBM, the turbo manufacturers themselves classify their products as incompatible with early PCs. In other words, when these products are combined, bugs and other problems may appear for which the manufacturer assumes no responsibility.—Winn L. Rosch

CORRECTIONS/AMPLIFICATIONS

God Speed (After Hours, *PC Magazine*, March 29, 1988) is distributed by Paraclete Software, 1000 E. 14th St., #425, Plano, TX 75074. We incorrectly stated that it was distributed by Kingdom Age Software.

Archive-Link and *VsCom* (PC Advisor, *PC Magazine*, February 29, 1988) are developed, produced, and marketed by M/H Group, 222 W. Adams St., Chicago, IL 60606, not by General Information Systems, as we reported.

In our review of *Congressional Toolkit* from BJ Toolkit (After Hours, *PC Magazine*, May 31, 1988), we incorrectly reported the company's telephone number. The correct number is (914) 271-8271.

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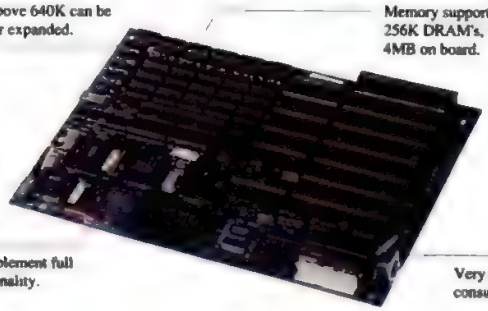

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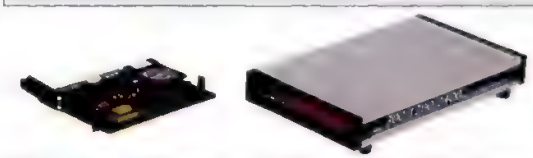

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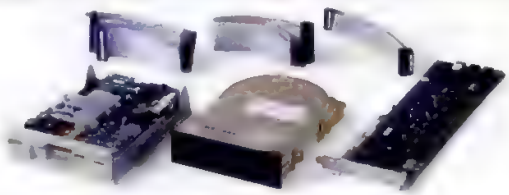

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GENERAL LEDGER

- user can define chart of accounts
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- automatically posts from receivables, payables, inventory and payroll so all statements are always current
- automatically displays account descriptions and numbers on screen
- distribute journal entries into multiple revenue or expense accounts, projects, profit centers or departments
- produces full audit trails
- zero balance accounts can be suppressed in reports

PAYROLL

- supports manual or computer produced checks
- automatically calculates all federal and state taxes, unemployment and disability insurance
- supports local taxes
- automatically posts payroll expenses to General Ledger and Jobcost
- allows seven income fields including pay advance and tip fields
- deducts for taxable benefits
- automatically retains QTD and YTD employee earnings, deductions and associated payroll expenses
- accumulates 940, 941, W-2 and state tax information
- produces immediate employee reports on screen or printer including W-2 forms, employee mailing labels, payroll journals, QTD and YTD reports of earnings & deductions, and employee record reports.

ACCOUNTS RECEIVABLE

- uses open invoice method to keep track of full or partial payments against any customer invoices
- fully paid invoice may be purged or retained
- automatically updates inventory and ledger accounts, and project records
- user can define aging periods
- reports produced on screen or printer including mailing labels, aged summary, aged detail and receivables journal
- automatically displays customer names and numbers on screen when required for program input
- prints computerized invoices or supports manual invoicing
- prints computerized customer statements with remittance stubs

ACCOUNTS PAYABLE

- uses open invoice method to keep track of full or partial payments against any supplier invoice
- fully paid invoices may be purged or retained
- automatically updates inventory records, project records and ledger accounts
- user can define aging periods
- produces immediate vendor reports on screen or printer including mailing labels, aged summary and details, and payables journal
- automatically displays vendor names and numbers on screen when required for program input
- prints computerized checks or supports entry of manual checks

INVENTORY

- suitable for manufacturers and wholesalers
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- updates from receivables and payables
- uses weighted average cost method
- handles adjustments and transfers
- automatically flags reorder levels
- reports can be displayed, printed or exported
- expresses selling and cost price to three decimals

JOB COST

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- produces reports on screen or printer including summary and detail reports on revenue and expenses for any project or departments

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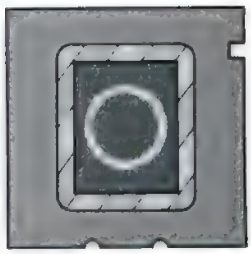

A low-cost way to liberate your monitor and keyboard from your system unit, and two products that reeducate the HP LaserJet Series II.

FROM A DISTANCE

I could make much better use of my limited workspace if I could move my system chassis to a cabinet top behind my desk and keep my keyboard and monitor on my desk. This would require that I route the monitor and keyboard cables some 20 feet, however. Any ideas?

Mauro Maschio
West Orange, New Jersey

As you've no doubt learned, moving your keyboard and monitor away from your system unit calls for a bit more than picking up a couple of extension cables. Signal degradation makes simple extension cables impracticable.

The Extender (Cybex Corp., 2800-H Bob Wallace Ave., Huntsville, AL 35805; (205) 534-0011) gets around the problem by boosting the TTL signals before they pass through the cable. Small metal boxes at each end of a ⅜-inch-diameter cable condition the signal and provide the hookups to your system, monitor, and keyboard.

The price of the Cybex kits varies, depending on the length of cable you need and the type of display you use. The Extender 1, which works only with monochrome systems, ranges from $120 for a 25-foot kit to $340 for a 250-foot kit. The Extender 2 works with monochrome, CGA, or EGA signals; it lists at $135 for a 25-foot kit and $245 for a 150-foot kit.

Cybex recently began shipping the Companion, a similar product that adds extra keyboard and monitor connectors at the system end. This allows you to hook two keyboards and monitors to your system—one close to the system chassis and one at a remote location. Prices start at $219 for an MDA/CGA/EGA-compatible 25-foot kit.

SERIES II POSTSCRIPT

I am in the market for a PostScript laser printer. I've heard that there is a product that gives the HP LaserJet Series II PostScript capability. Does such a product really exist? If so, how would such a combination compare with a straight PostScript printer?

Joan Brainard
St. Paul, Minnesota

The product is the QMS JetScript ($2,495; The Laser Connection, P.O. Box 850296, Mobile, AL 36685). JetScript is a full-length adapter you install in your system and a small board that installs in the option slot of the LaserJet Series II.

■ The Companion allows you to hook two keyboards and monitors to your system—one close to the system chassis and one at a remote location.

The adapter board furnishes the Adobe Systems PostScript interpreter, 3MB RAM, and a Motorola 68000 processor running at a speedy 16 MHz. The duo—JetScript plus the Series II—actually outperforms most standalone PostScript printers, thanks to the fast processing and the high-speed data transfer the adapter allows.

You also retain ability to use your LaserJet Series II in its native mode. The JetScript system provides a new hookup between your PC and printer, but it also allows you to maintain the standard parallel port connection. If you send output through that standard connection, your Series II functions as itself. Route output through the JetScript connection and the Series II functions as a PostScript printer.

By the time you add the $2,595 list price of the Series II to the cost of JetScript, you're in the price range you'd expect for a standalone PostScript printer. But the high-performance PostScript ability and the versatility of having two printers in one makes JetScript a smart buy.

Imagen Corp. (2650 San Thomas Expwy., Santa Clara, CA 95051; (408) 986-9400) recently announced a similar product—PC Publisher Kit—which should be shipping by the time this issue hits the newsstands. This $1,995 kit installs in the same way as JetScript. JetScript and PC Publisher Kit differ in other regards, however. Whereas JetScript includes a licensed Adobe PostScript interpreter, Imagen ships its own version of a PostScript-compatible interpreter with the PC Publisher Kit.

■ PC ADVISOR

The PC Publisher Kit also allows the Series II to handle another page description language, Imagen's Document Description Language (DDL), and emulate a wide range of printers. Printer emulations are provided for the Epson FX and MX-80; the Diablo 630; the IBM Graphics Printer; the NEC 3550, 5510, and 7710; and the Qume Sprint 5.

We had not yet received a PC Publisher Kit for evaluation when this issue went to press. Keep your eyes on First Looks for a hands-on review.

COMPAQ KEYBOARD

I recently bought a Compaq Deskpro/286 and I am very happy with the machine except for the mushy keyboard. Does any manufacturer produce an adapter that allows the IBM Enhanced keyboard to work on a Deskpro?

Dave House
Linden, New Jersey

The IBM Enhanced keyboard should work fine with your Deskpro, without an adapter. Your real problem will be finding a spare IBM keyboard. IBM doesn't sell its keyboards separately. Unless you manage to talk someone into swapping an IBM keyboard for a Compaq, your best bet is to find a third-party keyboard you can live with.

Personal preference rules when you are shopping for a keyboard. People seldom agree on which keyboard feels the best. Try to test as many keyboards as possible for yourself before you spend your hard-earned money.

Many IBM keyboard lovers have settled on Northgate Computer Systems' C/T 101 keyboard (2905 Northwest Blvd., #250, Plymouth, MN 55441; (612) 553-0631) as having the closest thing to a true IBM feel. At $99, the C/T 101 provides an IBM-like, clicky feel. The key resistance is noticeably lower than with an IBM, however.

DIALING UP AT&T

AT&T has long offered a toll-free technical support line ((800) 922-0354). Now AT&T's National Systems Support Center has started a bulletin board—a boon for you AT&T 6300 users who are grappling with AT&T-specific problems. The bulletin board includes informative notices that you can either scan on-line or download to read at your leisure. You can also leave messages.

The two access numbers are (201) 769-6397 and (201) 769-5616. Have your AT&T 6300 CPU serial number close at hand when you call: you'll need it for a membership questionnaire you must complete before you're granted access to the conferences.

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Microsoft C 5.0: The flagship of the Microsoft line runs up to 30 percent faster than its predecessor. Its new optimization features deliver untouchable execution speeds. 100 new additional library routines.

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Microsoft QuickBASIC 4.0: is a revolutionary concept in BASIC programming. It allows you to run, edit, debug, and run again. Our friends at Microsoft have eliminated the dreaded compile step. Whenever you edit your code QB4 automatically incorporates your changes, so that it can run a program of 150,000 lines in less than a minute.

Each member of this language family includes the renowned debugger CODEVIEW.

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Microsoft C	$450	$295
Microsoft Macro-ASSEMBLER	$150	$100
Microsoft QuickBASIC	$ 99	$ 65
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NOVELL: BTRIEVE, XQL, XTRIEVE

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Btrieve is a library of subroutines that allows the programmer to build a database application using any language. It takes complete charge of all file creation, indexing, reading, writing, insertion, deletion, forward and backward searching. Its balanced tree indexing scheme finds any key in a million in less than 4 accesses. .That's fast!

Btrieve is multi-lingual also. It includes more than 20 language interfaces (including C, BASIC, PASCAL, FORTRAN). However if it turns out that you are using something a little unusual, worry not. The manual includes a chapter on how to write a language interface to Btrieve.

Btrieve's vital statistics are equally impressive. Files may have up to 24 indexes; fixed record length to 4090 characters; variable length to 64K, indexes to 256 characters; files of 4 billion bytes. Network support includes Novell, 3-COM, IBM PC NET, Software Link's Multilink and many others.

XQL is a relational database management system designed especially for programmers. Imagine being able to access your database with the ease of SQL (Structured Query Language) statements and still having the power to process that data right down to the byte level.

Think about your applications. A large part of your software development effort is probably devoted to managing data stored in files on disk. Hours spent writing lines of code to search and store data records could have been used to program more important parts of your application. Why not let XQL do it for you. XQL will increase your programming productivity and let you focus on building better applications.

The XQL system works in tandem with Btrieve and has an equally powerful chassis. .No limit on the number of records per file. Max. file size is 4 gigabytes, Max. record size equals 4K, Max. indexes per file is 24. The one version works for single or multiuser systems, DOS Ver 3.0 or greater. All languages are supported.

Xtrieve is the final ingredient in the Novell programming recipe. It is a menu driven, data retrieval system, that allows you to quickly find information and display reports. System developers can easily customize Xtrieve to display command menus, help files, and error messages in the English spoken by the customer. Xtrieve screens then gives menu choices that users can quickly recognize, making Xtrieve an easy product to use and understand.

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Report Option/N	$345	$299

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Quality software? IBM thinks so. They sell GSS under their own label. Royalties. Needs 256k.

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PC MAGAZINE

FIRST LOOKS

Toshiba 386-Based T5100: Heavy on Performance, Light on Convenience

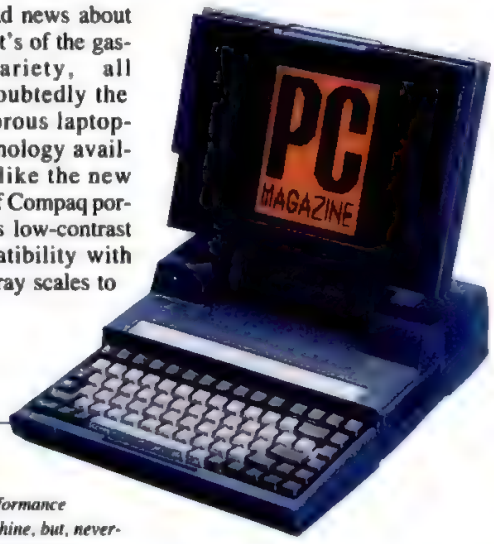
PC HANDS ON

BY JOHN DICKINSON

Given Toshiba's outstanding performance in the laptop arena, the company's new 386-based T5100 offers what at first seems like an ideal configuration for taking high performance on the road. Though not as speed-conscious as a few lunchbox-type portables, the T5100 is easily the fastest and most powerful laptop on the market.

However, using the T5100 for a while may convince you that this 15-pound laptop is not the ideal traveling companion.

The screen is the biggest source of bad news about the T5100. It's of the gas-plasma variety, all right—undoubtedly the most glamorous laptop-screen technology available. But, like the new generation of Compaq portables, it has low-contrast EGA compatibility with only three gray scales to simulate different colors.



The Toshiba T5100 delivers powerhouse performance for a laptop machine, but, nevertheless, it has its shortcomings.

In addition, Toshiba designers decided to try to take advantage of the 400 vertical dots on this screen by defining a character set that is one dot higher than the standard EGA character set. I found the resulting extra-tall characters rather annoying, whether using the normal single-dot or bold double-dot display.

My complaints to Toshiba about the low-contrast screen were answered with a new unit that admittedly sported a somewhat better screen. But even the better version couldn't compare to the GRiDCase 1350's high-contrast gas-plasma screen (see

(continues on page 35)

IZE: Links to Applications Add New Twist to Managing Free-form Text

PC HANDS ON

BY NEIL J. RUBENKING

At its worst, Persoft's *IZE* rates as an excellent free-form information manager. At its best, it constitutes an entirely new way of integrating the applications and information you use.

IZE achieves this integration by coupling an exceptional search engine with the ability to link to external files and their applications. In other words, when a search yields a link to a non-*IZE* file, following that link automatically invokes the appropriate application for editing the file.

There's no need to reenter volumes of existing data into *IZE*. *IZE*'s Import facility can bring in even large files containing many items and can split the files into separate "texts"—the basic unit of *IZE*.

You tie keywords to texts either manually or by using an automatic filter, known as a keychanger in Persoft parlance. If imported texts include lists of keywords, you can tell *IZE* where to find them by pinpointing their location within the document. *IZE* also sports its own editor, so you can create new texts within the package itself.

Once you've imported or created your texts, you're ready to begin searching—and appreciating the real power of *IZE*.

IZE provides all the keyword-searching abilities you'd expect from a free-form information manager, including the use of logical operators to combine keywords. You can also make use of fuzzy keyword searches—searches that return approximate matches as well as exact hits. A search of the fuzzy keyword "exit," for instance, might include a reference to a keyword "exist."

Macros allow you to specify common sets of keywords as one word. You can also search for words that are not keywords; *IZE* will search every text for the word at blinding speed.

(continues on page 34)

HANDS-ON INDEX

EMERALD BAY/EAGLE
Distributed database engine and front end 36

SUPER CARTRIDGE I
Replaces 23 HP font cartridges 38

DAN BRICKLIN'S DEMO II
Adds frame grabber 43

CURAM 80-8
32-bit RAM for the PS/2 Model 80 43

GEM SCAN
GEM-based scanning software 46

DRAW APPLAUSE
Presentation graphics 48

NORTHGATE POWER 386
Static-RAM cache and high-performance disk in a $4,295 system 54

Photograph: Thom O'Connor

IZE

(continued from page 33)

The *IZE* outline view—one of its most powerful features—helps you narrow your search and follow links once you've specified your keywords.

The outline lists each text targeted by your keyword search and totals up the frequencies of all the additional keywords in each selected text. Each entry in the outline is either a link to a text or a link to another outline. *IZE* ensures that the outline always fits on one screen.

You can expand sections of the outline, browse through all the chosen texts, or use the information the outline contains to build a new query.

To reach a file belonging to another application, you simply move the cursor to the corresponding "hot link" and press Enter. As long as *IZE* has a driver for the application that created the file, it will invoke the application and automatically load the correct file.

If you need to link to a program that's not one of the 25 or so already supported, you can create your own driver easily enough. Persoft documents the necessary information—such as directory path and program name—and the installation program includes an option to create a new driver.

The *IZE* editor definitely isn't for writing books. Its modest but complete text editor is best suited to shorter texts. The editor features easy mnemonic commands and simple formatting features, such as headers, footers, and margins.

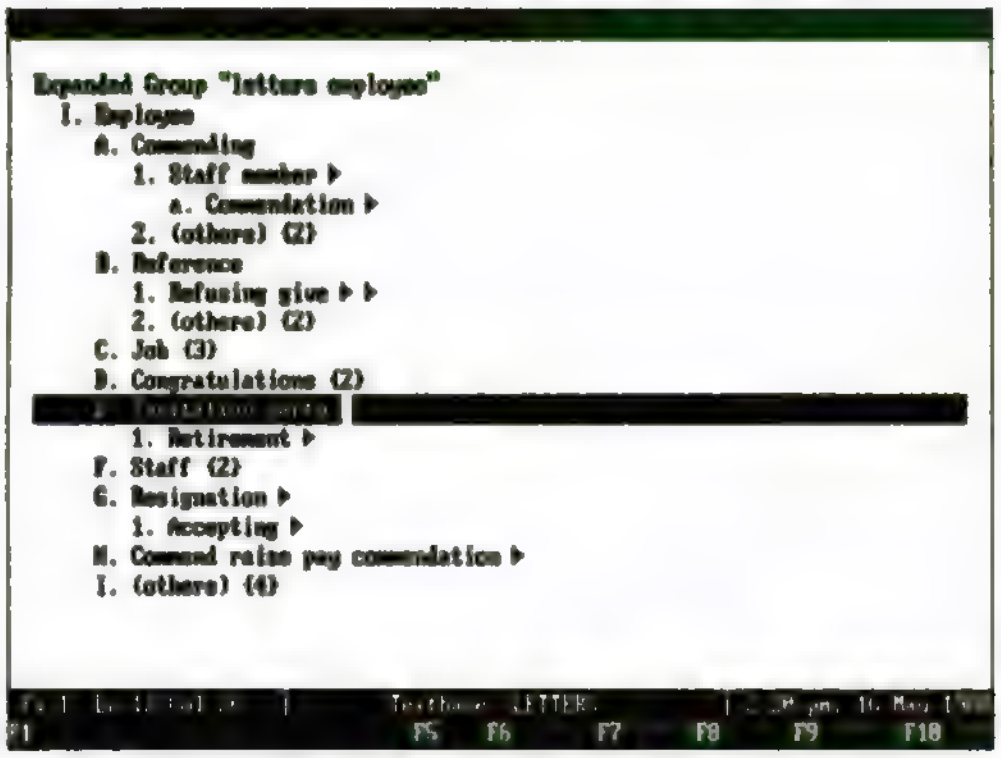
The editor supports all major printers, however, and is completely satisfactory for office letter writing. In fact, one sample textbase contains hundreds of standard form letters.

You can insert hypertext-like links between texts within the editor. Just tack down one end of the link, then find the other end and connect it. Thereafter, by simply hitting the Enter key with the cursor on the link symbol, you can jump back and forth between the linked texts.

Searching, linking, generating outlines—these are *IZE*'s specialties, and they're very fast. Other functions are not so fast, however. Allow hours rather than seconds for importing large files into the program.

Persoft may yet have a few loose bolts to tighten within *IZE*. Something in my true-blue antique IBM PC interacted nastily with it, disabling the application links. On an up-to-date 80386 machine, it worked beautifully but occasionally seized up on full text searches.

There's no handy physical metaphor for the way *IZE* links items in a textbase. It doesn't just offer a faster way to search free-form data. Rather, it offers a whole new way of working with your computer. You may find that the way you naturally work makes more sense than other applications have led you to believe. PC



The IZE outline screen represents links to texts with a solid arrow and links to other outlines with a number in braces. The number is a count of texts in the indicated outline

Agenda: Lotus's Answer to Information Management

Cross a pad of Post-its with a database, toss in a dash of hypertext, murmur the letters "AI," and you've got a rough approximation of *Lotus Agenda*. We got our hands on an early preview copy of this $395 "personal information manager," and, if reaction here is any indication, this program promises to be a hit.

While *Agenda*, *IZE*, Symantec's *Grandview*, and others share common ground as information managers, they're more different than any three word processors or databases.

Agenda is an organizer for thoughts, staffing plans, sales contacts, and ideas generated by blurbs in *Forbes*. Big deal: an outliner or a word processor outfitted with text retrieval software can hold that information, too. *Agenda*, however, doesn't restrict you to one or two static views of your information. It's a natural for anyone whose job involves managing ideas.

The *Agenda* metaphor comprises three building blocks: items, categories, and views. Items are how you enter information, categories are how you file information, and views are how you look at the information.

For example, I've been using a prerelease version of *Agenda* to manage *PC Magazine*'s feature story assignments. The elements are the year's 22 issues, editors managing the issues, topics, writers, and deadlines. Separate *Agenda* views might show the story lineup for a single issue, all the LAN reviews throughout the year, or stories written by individual authors. *Agenda*'s predecessor was a 10-foot-wide bulletin board covered with 3 by 5 cards.

Other bells and whistles:

- "Conditions" and "actions" help automate the organization of your thoughts. You might, for example, specify that any item containing the phrase "Quimby contract" be automatically routed to Phil, unless "Jennifer" is also in the item, in which case it's routed to her.
- Notes. You can add notes (10K) to your items, import, or simply reference external files. The external file could be an e-mail message or the text of a newspaper article on grain futures. *Agenda* can categorize or assign based on the content of the notes.
- Smart date arithmetic. *Agenda* understands "last Friday," "end of July," and "every Friday" as dates. It even understands "fortnight." You can restrict, or filter, your view to items falling between two dates.

The DOS version of *Agenda* is slated for shipping in a few weeks and the OS/2 1.0 version about 3 months later.

—Bill Howard

FACT FILE

IZE
Persoft Inc.
465 Science Dr.
Madison, WI 53711
(608) 273-6000
List Price: $445
Requires: 512K RAM; hard disk plus one floppy disk drive, or two high-density floppy disk drives; IBM PC, XT, AT, PS/2, or compatible; DOS 2.0 or later.
In Short: An excellent free-form information manager that goes beyond the ordinary. Startlingly fast keyword searches and the ability to invoke other applications put it in a class by itself.

CIRCLE 440 ON READER SERVICE CARD

Toshiba T5100

(continued from page 33)

PC Magazine, March 29, 1988).

As a consolation, the T5100 will accommodate an EGA monitor via a 9-pin D-connector on the system's rear panel. However, a separate EGA monitor is not exactly a luggable solution to the T5100's screen problem.

The T5100's overall performance leaves little to be desired. Indeed, Toshiba deserves credit for packaging so much power in such a small machine.

Its power comes from a 16-MHz 80386 Intel microprocessor, 2 MB RAM (which is upgradable to 4MB), and a 29-millisecond, 40MB hard disk drive. The standard configuration also packs a 1.44MB floppy disk drive and a socket for an optional 80387 numeric coprocessor.

The hard disk was the biggest surprise, earning an impressive 38-ms. access time on PC Labs Benchmark Tests. More importantly, it keeps up with most full-size machines when it comes to DOS file access times, where disk performance really counts. If Toshiba supplied a disk-caching program, the T5100's hard disk performance would rate even better.

The microprocessor and memory perform right up there with Compaq's Deskpro 386 (the company's 16-MHz machine) and, for that matter, any 16-MHz 386 you could name.

You're also not likely to come up with any compatibility problems running the T5100. Toshiba has been too successful at making PC-compatible laptops for too long to fool with anything that won't run the full gamut of DOS software. The T5100 ships with MS-DOS, Version 3.2, which is adequate but does not support *Windows/386*. Toshiba reports that DOS 3.3 is being prepared for distribution "at a later time," along with a laptop version of OS/2.

Toshiba makes one of the best portable keyboards around. It's got a predictably rattly feel that makes me feel at home, possibly because I'm so used to typing on a T1000. The keys are in a nicely compact arrangement that gives you all the keys on an 83-key keyboard, albeit in modified locations, and complies with most users' needs. Unless, that is, you're looking for a 10-key numeric keypad—which Toshiba will be happy to supply you with as an additional option.

It's hard to find this much computing power in a 15-pound package anywhere else. But one must wonder exactly what niche the T5100 will fill.

At 15 pounds, it's too heavy for my tastes in a laptop machine, and a laptop that requires a power cord seems like a silly idea to begin with. At $7,499, the T5100 is also expensive. If high-powered portability is your quest, a portable lunchbox-style computer like the Compaq or Dolch-Pack might serve your needs as well. After all, 20 MHz in Compaq's pail is only $500 away. PC

It's hard to find this much computing power in a 15-pound package anywhere else. But one must wonder exactly what niche the T5100 laptop will fill.

PC MAGAZINE FACT FILE

Toshiba T5100
Toshiba America Inc.
Information Systems Division
2441 Michelle Dr.
Tustin, CA 92680
(714) 730-5000
List Price: With 2MB RAM, gas-plasma screen, 1.44MB floppy disk drive, 40MB hard disk, $7,499
In Short: Exceptional performance for a laptop. But the machine's lackluster display, 15-pound weight, and power-outlet requirement cast doubts on its desirability.

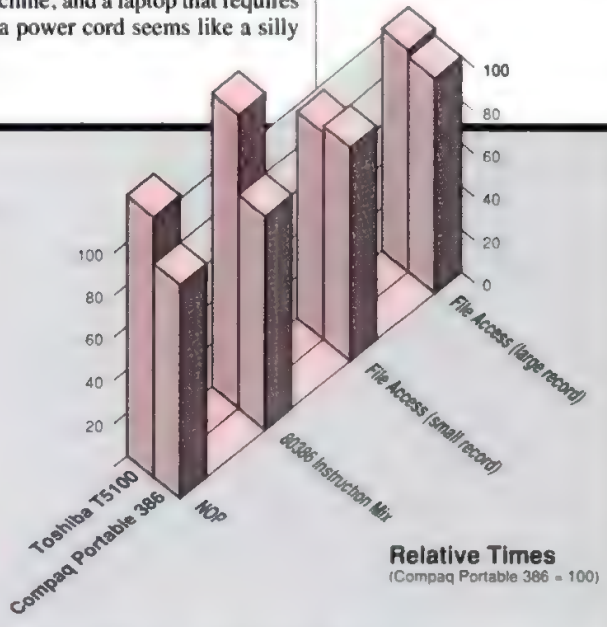
445 CIRCLE READER SERVICE CARD

PC LABS Benchmark Tests: Toshiba T5100 vs. Compaq Portable 386

Toshiba's 16-MHz 386-based portable pumps instructions at a slightly slower rate than Compaq's 20-MHz 386 portable, but the Toshiba's hard disk fetches data at speeds comparable to those of the Compaq portable.

Performance Times
(Times given in seconds)

	NOP	80386 Instruction Mix	File Access (small record)	File Access (large record)
Toshiba T5100	2.08	4.45	62.87	14.35
Compaq Portable 386	1.71	3.24	64.89	13.93



The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instruction in a big 128K loop.

The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The **File Access** benchmark test measures the time it takes to perform a series of disk operations: a sequential create and write of a 256K data file, a sequential read of the same file, a random write, and a random read. The first set of results reports the time required to perform the test using record lengths of 512 bytes and 4K. The second set of results is the time required to perform the same test using 16K and 32K records. The larger record sizes show how a disk will perform in loading large programs and loading and saving large data files. Higher-throughput systems such as RLL drives will show better performance in the large record test.

Emerald Bay and Eagle: The New Breed of Database Manager, Almost

PC HANDS ON

BY GENE SMILGIEWICZ

Migent's new distributed-processing duo—*Emerald Bay* and *Eagle*—represent the shape of database management systems to come. *Emerald Bay* comprises the database engine, while *Eagle* serves as a separate front end. The products are the brainchild of Migent founder Wayne Ratliff, who was instrumental in developing Ashton-Tate's *dBASE II*.

Though the *Emerald Bay Database Server*—the multiuser *Emerald Bay* engine—won't ship until the end of June, *Eagle* incorporates a single-user *Emerald Bay* engine that offers the same data-storage features without the multiuser capabilities.

Eagle, including its engine, is bug-laden and lacking in some features—a result of Migent's rushing the product to market. Migent has vowed to support purchasers of early releases "like kings," however, with a steady stream of free bug fixes, upgrades, and hot-line support, not to mention an ISV program for developers.

The single-user engine bundled with *Eagle* mirrors the coming *Emerald Bay Database Server* in its data storage abilities. The *Database Server* will add transaction processing and a powerful array of multiuser features.

The single-user engine comprises the database engine program and several core component utilities. The engine performs as a TSR program or a co-resident process occupying 130K RAM.

Emerald Bay databases are composed of up to 1,000 data tables contained in a single disk file, supported by a like number of indexes in a related index file. A database table record can contain up to 800 fields and 10,000 bytes, using the nine finite field data types that are available.

A variable-length "binary" field type, which did not function properly in the review copy, allows up to 2 billion bytes of storage per field and can contain any type of data.

The largest character field may be 512 bytes, while a special "packed" field can contain up to 1,024 numeric and punctuating characters. The four numeric data types offer similarly scaled precision. I particularly appreciated the field replication factor, which allows any field to be treated as a unidimensional array of up to 100 elements.

A data table can contain up to 2 billion records, and seven databases may be open at one time. In other words, up to 7,000 tables plus 7,000 indexes can be active at any time.

Using the database administrator is a straightforward process, though inexperienced users may be nonplussed by the impressive security provisions.

The data form generator and entry components are nothing to write home about, but the report writer, oriented to programmers, is well implemented and looks quite powerful.

The import/export module supports ASCII, *dBASE*, and *Lotus 1-2-3* formats, as well as creation of control files to facilitate repetitive operations.

Eagle

Once you've defined the tables and indexes for your databases, you can invoke *Eagle* and operate in command mode, á la *dBASE*, or develop and run application programs. As a nice touch, *Eagle* includes its own fine text editor.

This initial version does not supply the promised compiler or its ultimate feature set. It's also flawed by more than a few bugs. Nevertheless, I found it exciting to use.

Ratliff obviously reworked some of the basic functions botched in *dBASE*, implementing the *Eagle* features more effectively as a result. With *Eagle*, when you delete a record it is gone forever. No more annoying PACKing.

Gone, too, is the need to constantly index data. Once defined, indexes are maintained automatically, whether used to control a table sequence during updates or left "idle" during the process.

In general, *Eagle* is very elegant in the way it manages data storage and in the tools afforded to manage memory requirements. Modules of code and binary routines may be swapped in and out of memory at will. Memory-variable usage is limited only by available memory and may include 13-dimension arrays of up to 10,000 elements. The only price you pay for all this is more-stringent data typing requirements.

Eagle provides most of the commands and functions necessary to create complex application programs, as well as the means to create user-defined functions and to call external binary routines.

How well all these features work together under the stress of real-world loads will be open to debate until a stabilized version is available.

All in all, the intrinsic merits of the initial release of *Eagle*, with its single-user *Emerald Bay* engine, far outweigh its deficiencies.

The inherent superiority of Migent's distributed approach, coupled with the inspired coding of an older and wiser Wayne Ratliff, make *Emerald Bay* and *Eagle* worth wrestling with. PC

Distributed Database Processing

Distributed database processing separates the front-end user interface from the engine that performs the actual, nitty-gritty data storage and retrieval.

In a nondistributed DBMS, when a user indicates that he wishes to index a data file, for instance, the front end forwards the instruction to the integrated engine. The integrated engine in turn passes a request to the network file server to send the contents of the database over the network back to the workstation running it.

After the data records are indexed, the index file is saved back to the network server. Sending large files not only ties up the network but also increases the risk of data corruption due to transmission errors.

In a distributed DBMS, the engine runs on the server itself. The front end's workstation simply forwards a terse indexing instruction over the network to the database server. The database engine then performs the index operation on the file, located on one of the server's disks, and sends only a completion code back to the originating workstation when done.

—Gene Smilgiewicz

PC MAGAZINE FACT FILE

Emerald Bay
Eagle
Migent Inc.
865 Tahoe Blvd.
P.O. Box 6062
Incline Village, NV 89450
(702) 832-3700

List Price: *Emerald Bay Database Server*, $695; *Eagle* (incorporates single-user *Emerald Bay* engine), $495; Developer's Toolkit for C, $495.

Requires: 640K RAM, DOS 3.1 or later. Hard disk recommended.

In Short: A bug-laden but worthwhile initial release of a ground-breaking product. Comprises a separate database engine and front-end user interface for distributed processing. Not copy protected.

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- San Francisco Examiner

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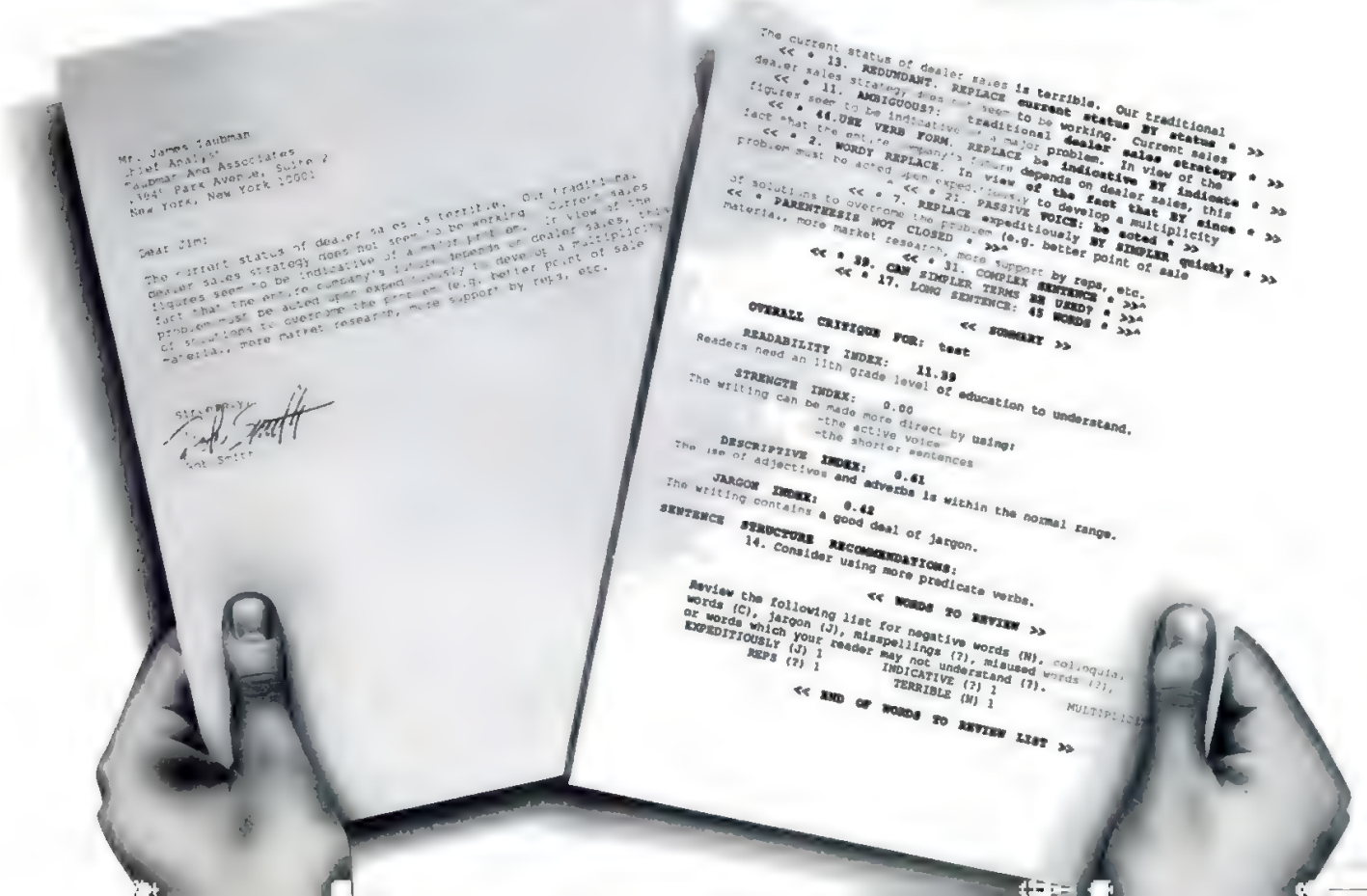

$699 Super Cartridge Squeezes 23 HP Font Cartridges into One

PC HANDS ON

BY EDWARD MENDELSON

The folks who designed Dick Tracy's ultraminiature wrist TV seem to have gone into the font-cartridge business.

IQ Engineering's $699 Super Cartridge I ($599 until September 1) shoehorns fonts from 23 Hewlett-Packard LaserJet cartridges into a single cartridge. The Super Cartridge is no bigger than the units it replaces; it's merely smarter.

The fonts look as good as Hewlett-Packard's best and, with most applications, you can plug in the Super Cartridge and start printing without fussing over printer drivers or escape codes.

The Super Cartridge I contains 55 fonts in ten different styles. In portrait mode you get Helvetica in sizes ranging from 6 to 14 point and Times Roman from 8 to 14 point. Letter Gothic ranges from 4 to 14 point. The Presentation font comes in 14- and 16-point sizes, OCR-A and Courier in 12 point, Prestige Elite (including math versions) in 7 and 10 point, Line Printer in 5 and 8.5 point, and Line Draw fonts in 12 and 14 point.

All the bold and italic variants that come in the Hewlett-Packard A through Z cartridges are included. Most of these styles are also included in landscape mode.

IQ Engineering couldn't find a way around the laws of physics or the hardware limitations of the LaserJet, so the Super Cartridge doesn't contain absolutely everything that comes in HP's cartridges. A few rarely-used landscape fonts are omitted. The crudely designed fonts in the obsolete B and F cartridges are ignored in favor of the superior versions in the "Microsoft" Z cartridge.

With most fonts you get only the standard ASCII character set, which means that you can print any character that appears on the keyboard but not the foreign-language characters that come in Hewlett-Packard's Roman-8 character set. But HP's math, legal, and line-drawing characters are fully present and accounted for.

With some effort, you can construct foreign characters using the accents and symbols that come in a special font. But for extensive foreign-language work, you're better off with the Courier font that comes with the LaserJet II or with one of HP's cartridges.

Before you join the circus-poster-and-ransom-note school of typography, keep in mind that the LaserJet lets you use only 16 fonts on a page—and two or three are plenty for good design. PC

Helvetica 8 point
Line Printer 8.5 point
Times Roman 10 point
Courier Bold 10 point
Helvetica Italic 10 point
Times Roman Bold 10 point
Prestige Elite 10 point
Helvetica 12 point
Letter Gothic Italic 12 point
Times Roman Italic 12 point
Letter Gothic 14 point
Times Roman Bold 14 point
Helvetica Bold 14 point
PRESENTATION BOLD 16 POINT

PC MAGAZINE FACT FILE

Super Cartridge I
IQ Engineering
P.O. Box 60955
Sunnyvale, CA 94086
(408) 733-1161
List Price: $699 ($599 until September 1).
Requires: HP LaserJet or compatible.
In Short: One font cartridge with the equivalent of 23 standard font cartridges.

CIRCLE 433 ON READER SERVICE CARD

A Tutorial Approach to Mastering DOS

PC BOOK REVIEW

BY GUS VENDITTO

If you're a regular reader of this magazine's Productivity columns, *Taming MS-DOS* is probably too tame for you. But it may be the book you should be recommending to less-fortunate users.

Old DOS hands who give this book and 10 minutes of their time to a rank novice can sit back and enjoy the rewards of having brought another new user into DOS adulthood—without answering questions every 20 minutes.

On the whole, the tutorials are well done and clearly explained. The book quickly moves into lessons on writing batch files that should prove rewarding to anyone willing to take the time to learn. Simple explanations of the boot sector and disk interleaves are short and to the point, and tricky concepts like ERRORLEVEL test statements are introduced and explained as they're needed.

This is far from a classic, however. It includes a hodgepodge of utilities Thom Hogan has written over the years. All of them are useful, but some, like a *WordStar* file stripper, seem to have been tossed in to fill pages. Hogan recommends that you upgrade to DOS 3.2, but includes utilities that provide functions added in DOS 3.2. He also rather glibly points his fledgling DOS users in the direction of MASM for creating DOS utilities.

If you want to turn your own system into a derivative of Hogan's, you can order a $25 disk with 21 utilities, plus the BASIC or assembler source code and a handful of batch files. All are common utilities, available more economically on public bulletin boards and PC MagNet.

Taming MS-DOS gives the effect of taking the reader on a tour of one man's approach to building a customized system. It works as a tutorial, but forget about the overpriced companion disk. PC

PC MAGAZINE FACT FILE

***Taming MS-DOS*, 2nd edition**
By Thom Hogan
M&T Books
501 Galveston Dr.
Redwood City, CA 94063
(800) 533-3271
(800) 356-2002 (in Calif.)
ISBN: 0-934375-87-9
List Price: $19.95; companion disk, $25.
In Short: A novice's guide to DOS functions and batch files.

CIRCLE 449 ON READER SERVICE CARD

New Disk Optimizer® gives you the courage to say yes!

Introducing Disk Optimizer 4.0. Now with Data Guardian™ and Undelete.

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As always, Disk Optimizer also gives you the safest, most advanced performance optimization available – proven by over a quarter of a million users.

The *Optimize* program speeds up disk reading and writing times by up to 300 percent by undoing the file fragmentation that takes place naturally over time. The *DOConfig* program lets you arrange the layout of your disk for best overall performance.

And the *Analyze* program gives you a graphical look at the condition of your disk, so you'll always know when it's time to optimize again.

FREE SOFTWARE OFFER
See Page 168 for details

A total of 17 different programs.

Disk Optimizer includes *Findfile* for locating files by name or wildcard anywhere on your disk. *Sorts* for re-arranging files and directories in the way that makes sense to you. *Lock* and *Unlock* for password-protected file security. *Killfile* for erasing sensitive data permanently. And lots more.

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PIPELINE

TOP TEN SELLERS

(A 5-week history)

1. **Lotus 1-2-3 2.01**
   Lotus Development Corp.
2. **dBASE III Plus 1.1**
   Ashton-Tate Corp.
3. **PC Tools Deluxe**
   Central Point Software
4. **WordPerfect 4.2**
   WordPerfect Corp.
5. **PFS:First Publisher**
   Software Publishing Corp.
6. **Dac Easy Accounting**
   Dac Software Inc.
7. **Samna Word IV**
   Samna Corp.
8. **Carbon Copy Plus**
   Meridian Technology Inc.
9. **The Norton Utilities Advanced Edition**
   Peter Norton Computing
10. **Quattro**
    Borland International Inc.

Rankings are based on net sales by unit; returns are subtracted from gross sales.

IN PERSPECTIVE

The Top Ten Sellers list ranks PC business programs according to their sales performance in the last week of a 5-week period. It also tracks programs' rankings (reading left to right) from April 4 through May 7. A 5-week history is charted to give a sense of a program's sales strength over time. Dramatic shifts in a particular program's ranking may be the result of sales promotions conducted by individual retailers. Seasonal factors, such as end-of-year-budget purchase decisions, can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

Sales information compiled by Ingram Software Inc.

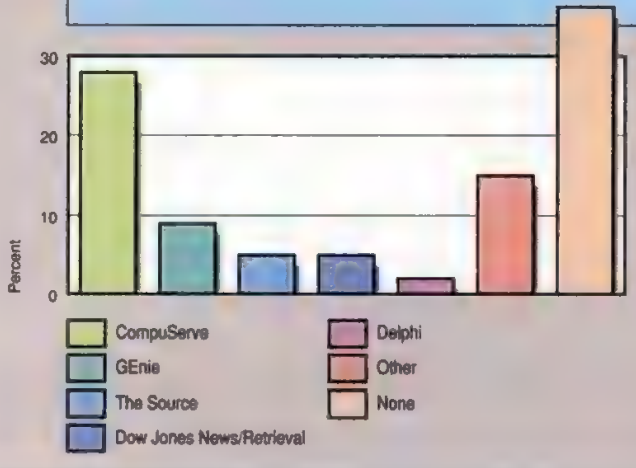
Many products that play a daily role in personal computing never get reviewed in *PC Magazine*. My fingers twinge as I write that, but it's a fact. We review every kind of software and hardware product that's available to help you get through your work, but some hardware can't be used alone and can be reviewed only within the context of a full system.

We don't review memory chips, because total system design determines how quickly your RAM can store and retrieve data.

We don't review the Phoenix and Award BIOS firmware—even though they are a crucial element in system performance—because you can't buy them for your own PC. The manufacturer of your computer had to select the best BIOS for you, and even if the company

SURVEY

Which on-line services do you use?



The gurus who told us that people would be using computers to shop from home were among the experts proven wrong in our most recent survey.

This survey was conducted on-line, so it polls only those who are already connected to on-line services, and it was conducted before the introduction of PC MagNet (see First Looks, page 46, May 31, 1988), which has attracted thousands of new users since it began on May 1.

The single most popular activity—special-interest groups—mirrors the popularity of CompuServe, home to several hundred such groups.

didn't make the right choice, there's nothing you can do about it (unless you're in the habit of burning code into ROM chips on a regular basis). Matching the right BIOS with the right PC design is a crucial decision for PC makers, but it's the finished system that has to be rated, not the BIOS.

Motherboard Choices

And we don't review motherboards (unless one was designed as an upgrade), although we'll often refer to them in reviews of systems. The performance of a particular motherboard is often the determining factor in whether one PC brand is a better buy than another. Many manufacturers rely heavily on commercially available motherboards; others, like Compaq, Tandy, and Zenith, put a lot of research into designing custom components that give their machines a competitive edge.

The most popular motherboards are sold by Intel to manufacturers. Companies like Kaypro, PC Discount, and Corvus Systems have built 386 PCs around Intel's motherboards, taking advantage of the extensive research Intel pours into these systems to ensure that they'll be compatible with the widest possible range of plug-in cards. Intel first built motherboards to test processors under development. It soon realized it had learned so much about system design and compatibility testing that a motherboard line was a natural complement to its existing businesses.

If you want to know about the immediate future of desktop computing, you need to take a look at this behind-the-scenes product from Intel.

We won't be reviewing Intel's latest 25-MHz 386 motherboard in the magazine, but we've taken a close look at it and are already starting to review the machines it powers. In the June 14, 1988, issue (First Looks, page 46), we reviewed the CAE/SAR 386II. If you want to know about the immediate future of desktop computing, you need to take a look at this type of behind-the-scenes product.

The market is already becoming crowded with hardware makers advertising that they've broken the latest clock speed limit. What many of them have done is built a machine around Intel's SYP 302, which has these standard features: a 386 running at 25 MHz; 2MB of system RAM (expandable to 8MB); a 64K memory cache; a 220-watt power supply; two serial ports; one parallel port; seven 16-bit slots; two 32-bit memory slots; and FCC Class B certification. The I/O bus runs at 8 MHz, ensuring compatibility with the modems, network cards, and graphics adapters on the market.

Purchase the right disks and controllers, place them inside a box, plug in the keyboard, and you have got a system that is at the forefront of PC technology.

If you wanted to make a system that was a couple of million instructions per second behind today's speed leaders but $3,000 less expensive than the $6,450 SYP 302, you'd use either Intel's SYP 301 or its SYP 301Z. Both are 16-MHz 386s; the 301 executes at one wait state, and the 301Z performs at zero wait states. Of course, you can't do this on your own, unless you're willing to order several hundred boards from Intel. But you could do worse than to purchase an 80386 PC based on an Intel motherboard.

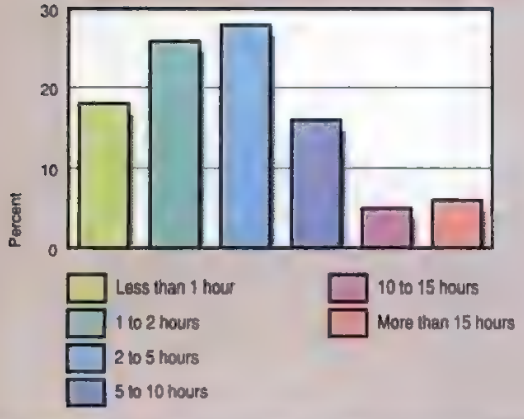
Boards That Run OS/2

Intel's compatibility testing will benefit consumers most when they're ready to boot OS/2. These boards are now running Microsoft's standard edition of OS/2. Using a nonstandard disk controller or video card could stop OS/2 before you've even completed its long-winded installation procedure, but since a majority of manufacturers use components that conform with current standards, this won't be a problem for most.

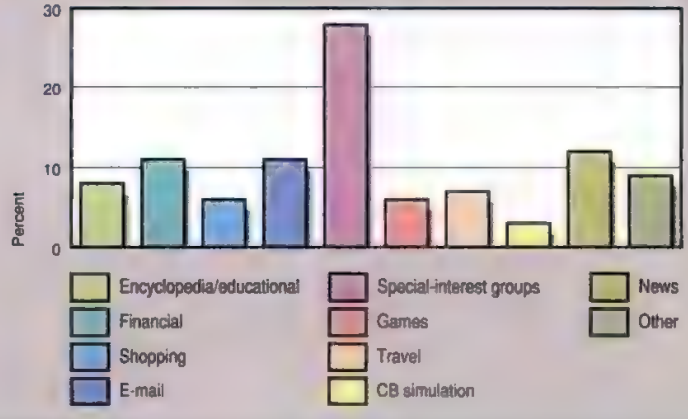
On the other hand, no OS/2 device drivers exist for some fairly popular storage devices (like Iomega's Bernoulli Box), so the OS/2-minded consumer can expect a few more gray hairs no matter which PC he decides to buy.

—Gus Venditto

How many hours per month do you use on-line services, on average?



What kinds of services do you use?



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*Time Line 3.0: PC Magazine Editors Choice 1986 & 1987, rated #1 by Software Digest 1987. Time Line 2.0 ($49.95) is the best choice for laptops or PCs without hard disks or with 640K RAM. Time Line 2.0 owners call (415) 964-4440 for low cost upgrade. Training and consulting services available, call (415) 898-1919.
†Think Tank, the original outline processor from the Living Videotext Division. © 1988 Symantec, 10201 Torre Ave., Cupertino, CA, (408) 253-9600.

CIRCLE 249 ON READER SERVICE CARD

Dan Bricklin's Demo II Adds Image Capture, More Programming Power

PC HANDS-ON

BY JENNIFER ZAINO

Software Garden laid in a good crop with the original *Dan Bricklin's Demo Program*. Not content to let the fields lie fallow, the company has come up with a new version: *Dan Bricklin's Demo II Program*.

Like its predecessor, *Demo II* lets you construct working program prototypes, demonstrations, and tutorials from a series of static screens, or slides. A programming language links the slides together.

Unlike the original, *Demo II* provides image capture and import features. You can now use *Demo II*'s CAPTURE utility to grab nearly any text or bit-mapped graphics screens.

With *Demo II*, you can also import text files or *PC Paintbrush* .PCX files. *Demo II* recognizes only certain types of .PCX formats, however. A handy utility helps you determine the type of your .PCX file.

You can also create your own screens or manipulate existing ones within *Demo II* itself. Screen-building features include a nice range of word-processor-like commands, including block operations.

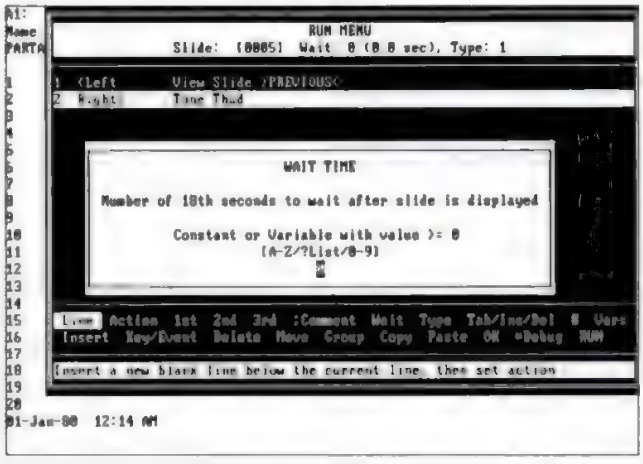
Some new Slides commands let you modify the slide switch speed and palette settings and change the switch type so that the screens move onto the display from top to bottom or vice versa.

Demo II adds about 100 new Run actions—the commands that link the slides. You can now instruct *Demo II* to flip through slides at a specified interval or to wait for user input before moving to a new slide. Run actions can apply only to specific slides or to all slides.

Both string and numeric variables are available in this version, as are several new overlay types.

Those familiar with the original *Demo* program will find the new version's manual much improved, although additional examples for the more-complex features would be a help.

A runtime-only version of *Demo II*, RDEMO2, is included at no extra cost. PC



Demo II's Run menu uses Key/Event indicators, which trigger the slide-show logic.

PC MAGAZINE FACT FILE

***Dan Bricklin's Demo II Program*, Version 2**
Software Garden Inc.
P.O. Box 373
Newton Highlands, MA 02161
(617) 332-2240
List Price: $195; upgrade, $54.95.
Requires: 512K RAM (256K for RDEMO2), one disk drive, DOS 2.0 or later.
In Short: A solid program that produces program prototypes, demonstrations, and tutorials. Not copy protected.

CIRCLE 431 ON READER SERVICE CARD

CuRAM 80-8: 32-Bit Memory for PS/2 Model 80 with Modem and Port Options

PC HANDS-ON

BY WINN L. ROSCH

Doing anything useful under OS/2 takes 4MB of memory. Yet the IBM PS/2 Model 80—IBM's premier engine for OS/2—ships with only 1MB, and IBM's own 32-bit memory enhancement board for the Model 80 is as hard to find as the moons of Pluto.

Enter Cumulus Corp.'s CuRAM 80-8—one of the first 32-bit memory boards for the Model 80.

The CuRAM 80-8 board avoids the use of DIP switches and jumpers by matching to SIMM type and memory capacity. It supports memory error detection and remapping, per IBM's MCA standards.

The CuRAM 80-8 also adds versatility via two optional daughtercards. You can choose a Hayes-compatible, 2,400-bit-per-second modem or a serial/parallel port combination.

The chip sockets of the CuRAM accommodate virtually anything, providing you match the byte size of the SIMMs within each bank. One bank of four 256K SIMMs gives the board its minimal 1MB endowment; two banks of four 1MB SIMMs stretches it to its maximum of 8MB.

Unbeknownst to most folks, all SIMMs are not interchangeable. Different products have different pinouts, which means they can't be plugged into most computers and expansion cards indiscriminately. But the CuRAM 80-8 automatically accommodates any standard SIMM on the market.

Cumulus also includes the necessary MCA setup software, an EMS 4.0 driver, and a print-spooling program.

The unit functioned perfectly in the 16- and 20-MHz versions of the Model 80, which have a maximum bus speed of 10 MHz. Cumulus claims the 80-8 will run at even faster rates, thanks to its ability to insert wait states automatically as a function of bus speed.

PC Labs benchmark test results put CuRAM performance on a par with that of Model 80 base memory. PC

PC MAGAZINE FACT FILE

CuRAM 80-8
Cumulus Corp.
23500 Mercantile Rd.
Cleveland, OH 44122
(216) 464-2211
List Price: With 1MB, $1,095; with 2MB, $1,495; with 4MB, $3,495; with 8MB, $5,495
Requires: PS/2 Model 80 (16 or 20 MHz)
In Short: A full 32-bit memory expansion board for the Micro Channel. Modem or serial/parallel port can be added.

CIRCLE 430 ON READER SERVICE CARD

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Q & A	185
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Revelation	459
Revelation Bump Disk	239
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$95 GEM Scan: Photograph to Halftone, Includes Pixel Editing

PC HANDS ON

BY MIKE FALKNER

Nestled among the flood of new products from Digital Research is *GEM Scan*, an image-scanning program. *GEM Scan* includes both the scanning software and *GEM/3*, DRI's desktop interface.

GEM Scan installs as a standalone application or a *GEM/3* desktop program. The package supports the HP ScanJet, the Canon IX-12 Image Scanner, Princeton's The Laser Scanner Model LS-300, the AST TurboScan, and the Microtek MS-300A.

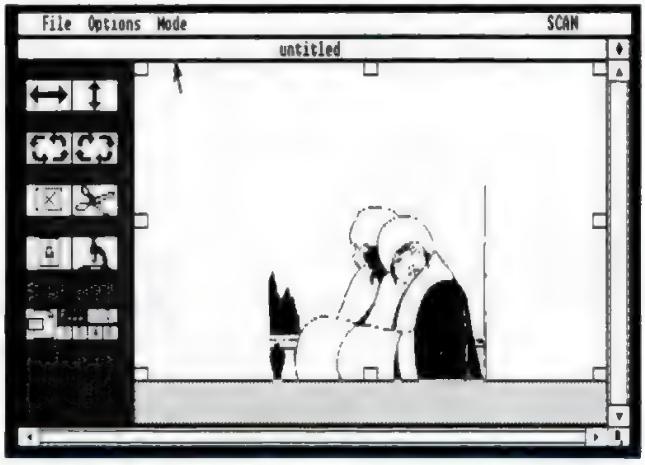
To scan an image, you simply load the picture into the scanner and click on a start-button icon. To fine tune the image, use the tool-kit to select either line art or halftones and to control the brightness. With the scaling tool you can reduce or enlarge the image.

The Options menu lets you redefine the page for smaller images and select the halftone pattern when your image is scanned. You can define two resolutions, a low one for a quick scan and a higher one to match your printer's resolution. There is also a contrast option, much like the brightness knob. With the Global option, you select the default drive, data directory, and one of two file formats, GEM's .IMG or TIFF.

To edit a scanned image, you select Edit from the Mode menu and *GEM Scan* displays a new set of tools. Using the frame in the work area, you can surround a portion of the image and rotate it left or right, flip it vertically or horizontally, or switch the dots from black to white or vice versa. With the microscope tool, you click on a small area and *GEM Scan* will blow up the image so you can edit one pixel at a time.

GEM Scan does have a few rough spots. For instance, your scanner must be hooked up to your system and turned on before you can run the program—a limitation you'll curse the first time you try to edit a scanned image on a system without a scanner. The program occasionally has problems saving TIFF files, though DRI reports that this problem is being solved.

Despite its shortcomings, *GEM Scan* is a nice addition to the GEM family of products. It scans and edits quickly and easily and produces formats usable by most popular desktop publishing packages. PC



The GEM Scan image-editing tools, the icons that are at the left of the screen, include the microscope tool used for pixel-level editing.

PC MAGAZINE FACT FILE

***GEM Scan*, Version 1.1**
Digital Research Inc.
60 Garden Ct.
Box DRI
Monterey, CA 93942
(408) 649-3896
List Price: $95
Requires: 512K RAM (640K recommended), two disk drives (hard disk recommended), one of five supported scanners, DOS 2.1 or later.
In Short: A GEM-based scanning package with a host of editing tools, image control features, and a few quirks. Not copy protected.

CIRCLE 442 ON READER SERVICE CARD

SolveIT Challenges MathCAD

PC HANDS ON

BY BARRY SIMON

Scientists and engineers often have to deal with problems that are too complex for desktop utility calculators but not demanding enough for specialized, number-crunching packages. Structured Scientific Software's *SolveIT*, like MathSoft's *MathCAD*, purports to be a scientific calculator for just such problems.

SolveIT is closely patterned after an RPN (Reverse Polish Notation) calculator but adds a host of built-in functions and some programmability.

The package's handling of complex numbers and root finding are particularly well done. It will also analyze data that you enter from the system keyboard or from an ASCII file, solve single differential equations, and handle differentiation and integration. Because you can define functions using other functions, you can also set up multiple integrals over nonrectangular regions.

There is much that *SolveIT* cannot do, however. There is no support of matrices, for example, and graphing—limited to a single function of a single variable—is displayed in CGA resolution even on an EGA or VGA system. You can print graphs only by using the PrtSc key, and then only if you have your own program that will send graphics dumps to your printer. And you can solve equations only in one variable.

In addition, the package's poor user interface makes it difficult to recommend. While some programs are faulted for making insufficient use of function keys, *SolveIT* seems to be unique in making virtually no use of the alphabet keys.

I found some of *SolveIT*'s underlying concepts especially appealing. But with its present user interface, the package is awkward to use. PC

PC MAGAZINE FACT FILE

***SolveIT*, Version 3.3**
Structured Scientific Software
1509 Queen Ave., SW
Albany, OR 97321
(503) 926-8599
List Price: $129, plus $4.50 shipping and handling; with Logitech Mouse, $219.
Requires: 512K RAM, mouse; Hercules- or CGA-compatible adapter required for graph display.
In Short: A powerful scientific calculator marred by a flawed user interface. Not copy protected.

CIRCLE 432 ON READER SERVICE CARD

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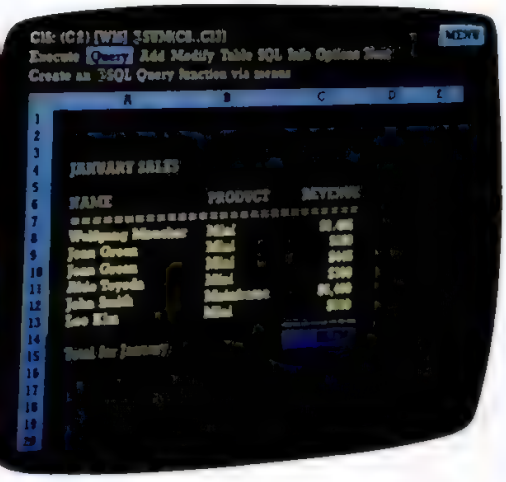

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> *PC Week, April 5, 1988*

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Draw Applause: Dazzling Special Effects, Meager Import/Export and Output Support

PC HANDS ON

BY MIKE DRIPS

Draw Applause—Ashton-Tate's new presentation graphics package—seems to have been designed with one task in mind: creating slick, professional-quality 35mm slide shows. This $495 package offers a combination of ease of use and dazzling special effects that other products only dream of.

The package is divided into three sections: the Chart Window, the WordChart Window, and the Picture Window.

The Chart Window provides the tools you'll need to create a bar, pie, line, or area chart. You enter the data to be graphed at the keyboard or import .DIF or .WK1 files. You can mix chart styles and use special enhancements, such as 3-D shading.

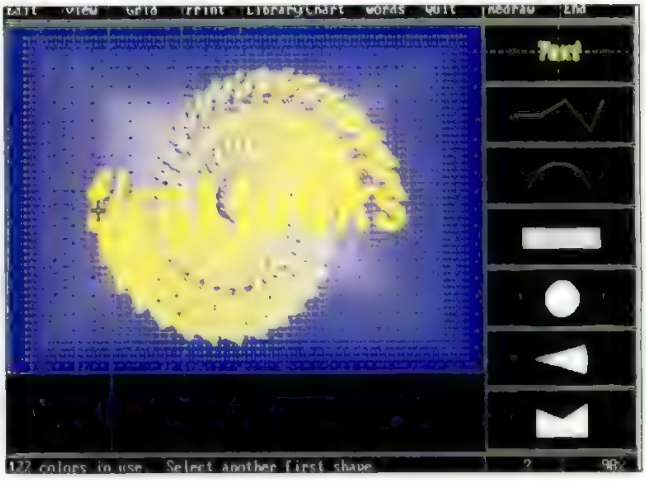
The WordChart Window provides seven templates for creating text slides. You can also create your own templates. The package offers several bullet types and a few variations of two type styles, Varitimes and Aristocrat.

After you create your graphs or text slides, you'll want to bring them into the Picture Window—the real core of *Draw Applause* and where this package really shines.

In addition to providing freehand-drawing features, the Picture Window allows you to create impressive special effects.

For instance, you can create shading and color fades using the color gradation feature. You pick a base color for the background and a second color, and the background will gradually change from the base color at the top of the screen, for instance, to the second color at the bottom. You can also create a glowing halo effect around objects or text. Other effects include spiraling text or distributed text for a coming-at-you effect.

If you'd rather tap someone else's artistic genius, you can load a choice of predesigned backdrops from the Gallery, which also includes a moderate collection of borders, symbols, and clip art. The backdrops include such effects as a line grid that appears to stretch back to a far-off horizon.



This EGA screen from Draw Applause *couples spiraled text and color gradation. You will need a PGA system to display the effects as they would appear on a slide.*

These features, and the package as a whole, prove easy and even fun to use. Unfortunately, *Draw Applause* suffers from serious shortcomings that may make prospective buyers think twice.

First, the package requires 640K RAM but supports neither extended nor expanded memory. In fact, just having the LIM 4.0 EMS driver in memory prevented *Draw Applause* from running.

My most serious complaints with *Draw Applause* center around its island-unto-itself approach, however. The package supports .DIF and .WK1 formats for data import but leaves out ASCII support. Only .CGM format is supported for graphics file import and export. At a time when most graphics packages bend over backwards to support as many formats as possible, *Draw Applause*'s sparse support is difficult to understand.

Draw Applause also gives you few options for producing your exotic color images once you've created them. The package supports only one film recorder, the Matrix Instruments PCR, and two color printers, the IBM 5182 and the Tektronix 4696. If you use a plotter, you may be in luck—the package supports a nice range of HP and IBM plotters. You'll also find a nice list of black-and-white printer support.

Perhaps even more annoying than the meager color-image output-device support is the package's seeming dependence on Ashton-Tate's own slide-production service, the Ashton-Tate Graphics Service.

You can create images on your screen that only the Ashton-Tate Graphics Service can reproduce, as indicated by the following quote from the *Draw Applause* manual: "If you select rounded corners and draw a line with more than 32 points or a free-form with more than 30 points, the shape is not displayed with rounded corners on the screen, or in plotter, printer, or film recorder output. If you send the image to Ashton-Tate Graphics Service, however, rounded corners do appear in the finished slide." Similar notices are scattered throughout the manual.

In addition, only a PGC-standard adapter and display will give you on-screen results anywhere close to the slide output. An EGA system will give you a rough idea of what to expect from a slide.

Assuming you don't mind sending your files to the Ashton-Tate service, you'll undoubtedly get excellent results. *Draw Applause* even contains communications features that let you transmit an image to the service via modem. Standard next-day service will cost you $5 per 35mm slide. The service also offers full-color transparencies, color prints, and black-and-white prints.

The bottom line? If you're looking for a package to produce quick-and-dirty graphics for in-house use, go with a product that offers more choices for importing, exporting, and producing graphs. If only the highest-quality output will do, however, *Draw Applause* may be just what you need. PC

PC MAGAZINE FACT FILE

***Draw Applause*, Version 1.0**
Ashton-Tate Corp.
25 Sylvan Rd South
Westport, CT 06880
(203) 222-1974
List Price: $495
Requires: 640K RAM; hard disk drive; EGA, PGC, or VGA display; DOS 2.1 or later.
In Short: An easy-to-use presentation graphics package capable of generating stunning color slides for professional-quality presentations. Meager import/export and output-device support may make it impractical for general use, however. Not copy protected.

CIRCLE 448 ON READER SERVICE CARD

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CIRCLE 390 ON READER SERVICE CARD

NEW ON THE MARKET

by Michael W. Muchmore

Everex and ALR Unveil Their Speediest PCs: The 25-MHz 80386s

Rising clock speeds and ever-more-sophisticated memory caches have prompted several manufacturers to insist that their 80386 machines are the fastest to be found.

The Step 386/25, a 25-MHz 80386-based PC, has a scalable memory-caching scheme previously found only on mainframes, according to **Everex Computer Systems Division**. The Advanced Memory Management Architecture wrings a 6-mips performance from the 80386, Everex says.

The Step 386/25 comes with 1MB of zero-wait-state memory, which can be increased to 16MB. Also standard is a 1:1 interleave hard-and-floppy disk controller, a 101-key board, five drive bays, math coprocessor support, and MS-DOS 3.3. The machine is Novell, Unix, and Xenix compatible as well.

Meanwhile, **ALR (Advanced Logic Research)** of Irvine, California, claims *its* 25-MHz system is the world's fastest microcomputer. The FlexCache 25386 uses proprietary 64K 82385 cache emulation and zero wait states, ALR says. The standard 1MB RAM can be increased to 14MB without resetting switches.

The 25386 uses an ESDI controller with 1:1 interleave and full-track buffering for the 150MB ($9,499) and 300MB ($12,499) hard disk versions.

The floor-standing system box accommodates up to two full-height hard disks and three half-height devices.

One 1.2MB 5¼-inch floppy disk drive, 80387 support, and one serial and one parallel port are standard.

Advanced Logic Research's $9,499 FlexCache 25386 runs at 25 MHz

List Price: Everex Step 386/25, call company. Everex Computer Systems Division, 48431 Milmont Dr., Fremont, CA 94538; (800) 356-4283.

CIRCLE **437** ON READER SERVICE CARD

List Price: ALR FlexCache 25386, with 150MB hard disk, $9,499; with 300MB hard disk, $12,499. Advanced Logic Research Inc., 10 Chrysler, Irvine, CA 92718; (714) 581-6770.

CIRCLE **438** ON READER SERVICE CARD

Two Hand-held Scanners Enter the Market: Logitech ScanMan and Mitsubishi MH 216

Hand-held scanners from **Logitech** and **Mitsubishi Electronics America** join Saba's entry in an increasingly crowded field.

Logitech, of Fremont, California, has announced the $299 ScanMan, a hand-held scanner, along with scanning software called *ScanWare*. *WinScan*, a utility for scanning images directly into a *Microsoft Windows* clipboard, is also included with the scanner.

The ScanMan offers 200-dot-per-inch resolution along a 4-inch scanning width. It can scan in this width for 11 inches.

Scanned images can go directly to a TIFF file, into a *Windows* clipboard using *WinScan*, or into an included graphics editor. The graphics editor can resize, cut and paste, color, rotate, insert, and magnify scanned images.

Mitsubishi's 8½-inch-wide hand-held scanner can attach to a paper feeder to emulate a flatbed or sheet-feed scanner. The $995 MH 216 scans 16 gray shades at 200 dpi at a rate of 10 seconds per page.

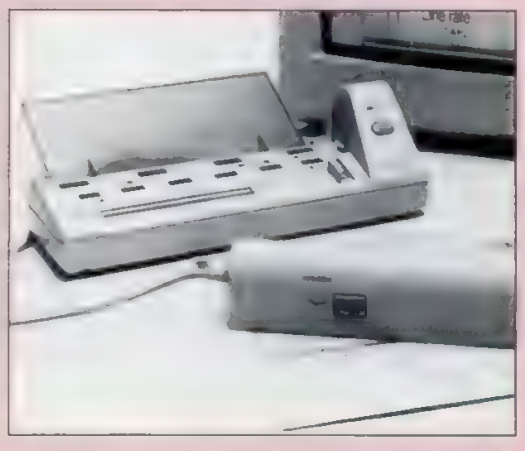
A contact-type charged-couple device (CCD) speeds scanning, and rotary encoders are used to cope with speed changes in manual scanning, Mitsubishi reports. Two sets of rollers keep hand-scanning motion in a straight direction.

Images from both company's scanners are usable in such applications as Aldus's *PageMaker*, *Ventura Publisher*, *PFS:First Publisher*, and ZSoft's *PC Paintbrush*.

The ScanMan scans 200 dots per inch and comes with ScanWare software and a WinScan utility that allows you to scan directly to Windows

List Price: ScanMan, $299
Requires: *ScanWare*: 640K RAM, hard disk, DOS 2.0 or later; mouse recommended. Not copy protected. Logitech Inc., 6505 Kaiser Dr., Fremont, CA 94555; (415) 795-8500.

CIRCLE **439** ON READER SERVICE CARD



The $995 Mitsubishi MH 216 scanner is 8½ inches wide, scans 200 dots per inch, and can attach to the MH 01FA, an automatic paper feeder that lets it emulate either a flat bed or a sheet feed scanner

List Price: Mitsubishi MH 216, $995; MH 01FA sheet feeder, $260
Requires: Software: 640K RAM, hard disk, DOS 2.1 or later. Not copy protected. Mitsubishi Electronics America, Computer Peripherals Division, 991 Knox St., Torrance, CA 90502; (213) 515-3993.

CIRCLE **440** ON READER SERVICE CARD

MicroDirect Complete Portable Office Joins Laptop, Cellular Phone

If you need to communicate with your office PC from a location with no power source and no telephone line, you can use the Complete Portable Office (CPO), from **MicroDirect**, of Everett, Massachusetts.

The CPO is based on MicroDirect's Turbo Laptop computer and a Panasonic cellular phone. A modem, a modem/cellular interface, and the 3-pound Diconix laptop printer round out the $4,995 system. For $5,500 you get a 20MB hard disk drive in the laptop.

The Far East–built Turbo Laptop has an 80C88 microprocessor and 1 MB RAM (640K for DOS and 384K of EMS memory). An 80-column, 640 by 200 backlit supertwist blue/green liquid crystal display is standard.

(continues on page 52)

HOT PROSPECT

Mitsubishi Challenges Toshiba T3100 with Big-Screen MP286L

Posing a challenge to Toshiba and other laptop producers, **Mitsubishi Electronics America** claims that its MP286L laptops have the largest, most readable displays of any portable computer.

The 11-inch cold cathode-ray tube (CCT) screens show black characters or graphics on a white background. Screen colors can be reversed with the flip of a switch. Neutral twisted nematic (NTN) technology makes the display readable in all light conditions, according to Mitsubishi.

A built-in CGA controller can support an external monitor as well as the page-white display. Mitsubishi says that EGA will be available in the fourth quarter of 1988.

Though Mitsubishi labels the 15.9-pound machines as laptops, the systems require an AC plug or a third-party external battery pack. The sleek black chassis measures 12.3 by 14.2 by 3.5 inches.

The laptops run an Intel 80286 microprocessor at either 8 or 12 MHz, and an 80287-8 coprocessor is optional. The MP286L comes with 640K RAM, expandable to 2.64MB.

There are four proprietary expansion slots, one parallel and two serial ports, and a clock calendar.

A dual 3½-inch disk drive configuration ($3,195) and a 20MB hard disk configuration ($3,995) are available.

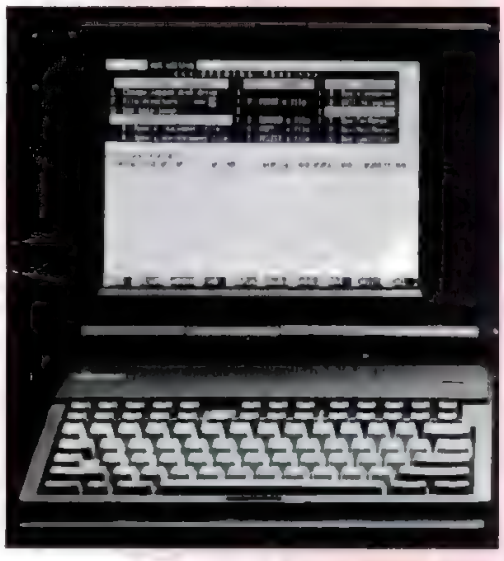
The U.S.-assembled lunchbox computer has standard a 78-key keyboard, with twelve function keys across the top and cursor keys at the top right.

Hardware options include a 2,400-bit-per-second modem, an external 3½-inch floppy disk drive, and a 17-key numeric keypad.

Both DOS 3.3 and GW-BASIC 3.2 are standard; OS/2 is optional.

List Price: Mitsubishi MP286L, with two floppy disk drives, $3,195; with 20MB hard disk, $3,995. Mitsubishi Electronics America, Computer Peripherals Division, 991 Knox St., Torrance, CA 90502; (213) 515-3993.

CIRCLE **436** ON READER SERVICE CARD



Mitsubishi says its $3,195 MP286L portable computer has the largest, most readable screen in its class. The computer has an 80286 microprocessor running at 12 MHz.

MicroDirect's $4,995-to-$5,500 CPO (Complete Portable Office) comprises a laptop computer, modem, cellular phone, adapter, and printer.

MicroDirect

(continued from page 51)

The built-in Hayes-compatible modem transmits at 1,200 bits per second using Bell or CCITT standards. A telcon connector on the side of the laptop connects the PC to a cellular phone adapter, or a telset connector can be used with a regular phone.

List Price: MicroDirect Complete Portable Office, $4,995; with 20MB hard disk, $5,500. Turbo Laptop alone, $1,895; with 20MB hard disk, $2,795. MicroDirect Inc., 2010 Revere Beach Pkwy., P.O. Box 835, Everett, MA 02149; (617) 387-2200.

CIRCLE **441** ON READER SERVICE CARD

Keyboard Doubles as Diskless LAN Station

It looks like an obese 101-key keyboard, but **PC Office**'s NT-10 is actually a 16-bit computer, complete with an 80C86 processor. The diskless NT-10 is compatible with NetBIOS LANs, Novell's *NetWare*, and twisted-pair LANs.

PC Office says the company was able to fit a networking system unit in a keyboard by putting all network hardware on a single custom integrated circuit that combines the functions of 35 ICs. The result is circuitry that generates very little heat, obviating the need for a fan.

The $995 workstation can be purchased with 0K, 512K, or 1MB RAM (with support for LIM 4.0 expanded memory) installed, and it accepts standard SIMMs. On the back of the unit are CGA, monochrome, and Hercules connectors (selectable by switch); LAN connections; parallel and serial ports; and a 10-watt power input for use with an included transformer.

List Price: PC Office NT-10, with 512K, $995. PC Office, 4631 Viewridge Ave., San Diego, CA 92123; (619) 268-3235.

CIRCLE **443** ON READER SERVICE CARD

The NT-10 from PC Office is more than a keyboard: it's a $995 intelligent LAN workstation featuring an 80C86 microprocessor.

FASTMICRO

ORDER LINE: 1-800-441-*FAST*

COMPUTERS

Avantage286

10 Mhz-0 Wait
Norton SI = **11.5**

$969 Complete

Base System Includes 512K, 1.2MB Floppy Drive, Dual Speed (6 & 10Mhz) 80286, 8 Expansion Slots, Monochrome Graphics Adaptor, TTL High-Res Tilt & Swivel **Amber Monitor**, Parallel Printer Port, 200W Power Supply, Clock/Calendar, Enhanced AT-Style Keyboard and Learning Software.

Base System With 20MB 28ms Seagate Hard Disk **$1249**

Base System With **40MB** 40ms Seagate Hard Disk **$1399**

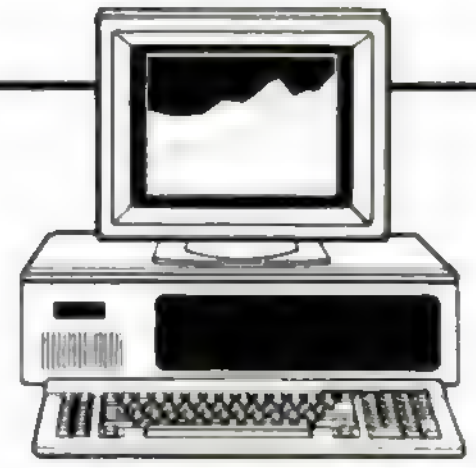
All Systems Come With A One-Year Warranty

Color System Add: $200

Avantage88

8 Mhz 8088
Our Prices Include Monitor!

$599 Complete



Base System Includes 640K, 360K Floppy Drive, Dual Speed (4.77 & 8 Mhz) 8088, Monochrome Graphics Adaptor, TTL High-Res **Amber Monitor**, 150W Power Supply, Parallel Printer Port, AT-Style Keyboard and Learning Software.

CALL FOR UP TO THE MINUTE PRICING

Base System With 20MB Seagate Hard Disk **$849**

Base System With **30MB** Seagate Hard Disk **$899**

Special! Quattro $119

EGA System Add: $400

HARDWARE

PRINTERS

	LIST	*FAST*
Brother		
M1709	599	429
Citizen		
120D	229	145
180D	259	165
MSP40-55		Call
Tribute 124	699	449
Tribute 224	949	599
Diconix		
150P	499	307
Epson		Call
Fujitsu		
DL3400	995	549
NEC		
P2200	499	329
P5XL	1295	Call
P5200	699	Call
P5300	995	Call
LC890	4799	Call
Okidata		Call
Panasonic		
KXP1080i-2	299	169
KXP1091i-2	329	195
KXP1595	749	Call
KXP1524	949	Call
Star		
NX1000	289	179
NX15	499	299
NB2410	699	449
Toshiba		
P321SL	749	497
P341SL	999	655
P351SX	1499	899

BOARDS

	LIST	*FAST*
AST		Call
ATI		
VIP VGA	449	259
Chicony Keyboards		
5060 84 Key	79	49
5161 Tactile	99	65
Everex		
1200B Int Modem	149	73
2400B Int Modem	249	149
Genoa		
Super EGA Hi-Res+	399	179
Super VGA Hi-Res		Call
Hercules		
Graphic Card +	299	173
VGA	399	249
Intel		
8087-2	250	149
80287-8	410	249
80287-10	480	287
Above Board 286	645	349
Inboard 386 1mb	995	749
Orchid		
Designer VGA	445	269
Tiny Turbo 286	445	269
Twin Turbo 12mhz	645	379
Paradise		
Basic EGA	199	119
Autoswitch 480	349	149
VGA Plus	399	235
5 Pack 0K	129	59

	LIST	*FAST*
Prometheus		
Promodem 1200B	119	75
Promodem 2400B	199	119
Promodem 2400G	249	159
Quadram		Call
Std. Microsystems		
PC110	295	149
PC210	335	199
PS110	695	499
Video 7		
Vega Deluxe	379	179
Vega VGA	499	269
LAPTOPS		
NEC		
Multispeed	1995	1199
Multispeed EL II	2295	1449
Multispeed HD	3695	2295
Sharp		Call
Toshiba		
T1000	1199	749
T1200F	2399	1495
T1200H	3499	2195
T3100/20	4699	Call
Zenith		Call
FACSIMILE		
Bell Office 71001	2099	1399
Toshiba		
30100	1795	1249
3700	2495	1699
Panasonic FXBM89	999	659
Sharp UX-140	1499	999

DISK DRIVES

	LIST	*FAST*
Fujitsu		
360K Floppy	119	77
Miniscribe		
40MB AT #3650	499	299
40MB XT #3650	599	379
Mitsubishi		
360K Floppy	149	79
1.2MB Floppy	199	99
720K 3.5" Floppy	199	99
Priam		Call
Seagate		
20MB XT Kit #225	599	267
30MB XT Kit #238	699	297
30MB AT #138	599	339
40MB AT #251	899	449

MONITORS

Amdek		
1280	999	669
310A	230	99
732 VGA	625	399
Magnavox		Call
Mitsubishi		
1409 RGB	399	259
1410 EGA	599	399
Diamond Scan	799	485
NEC		
Multisync II	899	569
Multisync GS	279	189
Princeton		
Ultrasync	849	525
Thompson		Call
Zenith 1490	999	595

Call On Non-Listed Items

SOFTWARE

Database	LIST	*FAST*
Clipper	699	359
dBase III+	699	359
dBXL	199	109
Foxbase Plus	395	189
Paradox	725	419
Quartz	795	449
RapidFile	295	169
Rbase for DOS	700	429
Reflex	150	84
Q & A	349	179
Desktop Publishing		
Byline	295	175
GEM Desktop Pub.	299	169
Pagemaker		Call
PFS:First Publisher	99	55
Publisher's Paintbrush	285	149
Ventura	895	459
Financial		
Computer Associates		Call
DAC 2.0	99	59
DAC P/R	69	39
Dollars & Sense	179	99
In-House Accountant	99	59
Managing Your Money	199	117
Peachtree Complete	199	149

Special! Quattro $119

Graphics	LIST	*FAST*
Boeing Graph	395	199
Deluxe Paint II	105	67
Draw Applause	495	269
Freelance Plus	495	299
GEM Draw Plus	299	165
Generic CADD	99	57
Harvard Graphics	495	Call
PrintMaster Plus	60	30
Integrated		
Ability Plus	259	149
First Choice	149	77
Smart System	895	427
Works	199	117
Windows	99	59
Windows 386	195	117
WordPerfect Exec.	249	117
Mice/Accessories		
Logitech C7 Serial/Bus	119	67
Logitech HiRes	150	87
Microsoft Serial/Bus	150	97
PC Mouse	149	89
Datashield 85	90	50
Datashield 100	99	57

Programming	LIST	
Macro Assembler	150	89
Norton Guides	100	58
Turbo Basic	99	58
Turbo C	99	58
Turbo Pascal	99	58
Quick Basic	99	59
Quick C	99	59
Spreadsheets		
Excel	495	Call
Lotus	495	Call
PFS: Pro Plan	99	51
Plan Perfect	395	167
Quattro	248	119
Worksheet Utilties	100	59
Utilities		
CoreFast	149	87
Desklink	170	95
Formtool	95	54
Laplink	130	75
Norton Advanced	149	74
PC Tools Deluxe	80	36
Sidekick Plus	195	119
XTree	70	34

Word Processors		
4Word	100	55
Easy Extra	99	55
GEM First Word Plus	199	117
Manuscript		Call
Multimate Adv. II	565	247
Professional Write	199	105
Sprint	195	139
Q & A Write	199	119
Volkswriter	295	Call
Webster's Writer	100	54
Word	450	Call
Word Perfect	495	189
Word Perfect Library	129	54
WordStar	350	Call

Call On Non-Listed Items

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CIRCLE 352 ON READER SERVICE CARD

Northgate Power 386: Premium Performance at a Bargain Price

HANDS ON

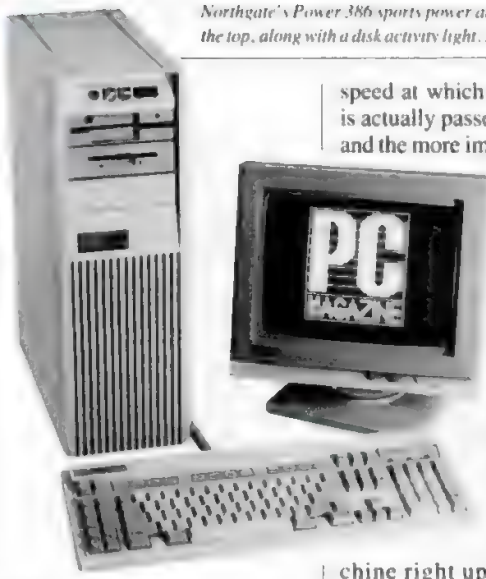
BY BILL O'BRIEN

Field-leading 386 performance just got cheaper. Northgate Computer Systems' Power 386 rivals the power of the Compaq Deskpro 386/20 at a fraction of the cost.

The Power 386 is an upright, 20-MHz floor model with a base price of $4,295—including a high-performance 65MB hard disk.

A 64K static RAM memory cache deserves much of the credit for the Power 386's performance. Like the Deskpro 386/20, the Power 386 maintains a high-speed, 32-bit path to memory, separate from the I/O bus.

Whereas the 386/20 makes use of Intel's sophisticated cache controller chip, however, the Power 386 falls back on a direct-map static RAM system composed of discrete logic components. Compaq's solution no doubt earns it memory access performance gains in some cases, but the Power 386 won't be far behind.



Northgate's Power 386 sports power and reset switches at the top, along with a disk activity light. Inside are eight slots.

The hard disk drive does not have an overly spectacular track-to-track access time—28 milliseconds—but that is a mechanical measurement of disk capability. Data throughput, the speed at which the information is actually passed across the bus and the more important measure of performance, rates as spectacular when hard disk caching is enabled. But even without caching, the large- and small-record times for the PC Labs benchmark tests rank the Power 386 machine right up there with the Compaq Deskpro 386/20.

The standard configuration includes a 14-inch monochrome monitor, one 5¼-inch 1.2MB floppy disk drive, and one 3½-inch 1.44MB floppy drive. That leaves you with one empty half-height bay.

Whether you purchase this 386-based machine for its price tag or for its performance, the chances are that you won't be disappointed. Watch *Microsoft Windows* load quickly for a change, or observe a pull-down menu snap up like a runaway window shade, and you will finally get an honest feel of what speed is all about.

FACT FILE

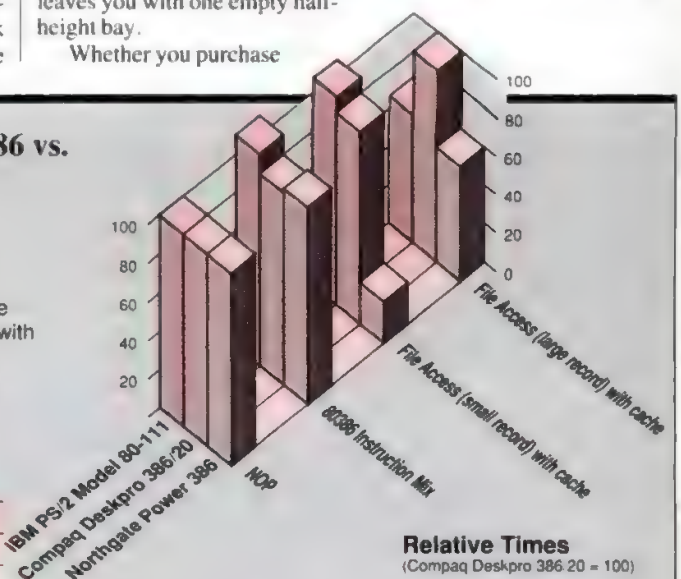
Northgate Power 386
Northgate Computer Systems
13895 Industrial Park Blvd., #110
Plymouth, MN 55441
(612) 553-0111
List Price: With 1MB DRAM, 64K SRAM cache, one 5¼-inch 1.2MB floppy disk drive, one 3½-inch 1.44MB floppy disk drive, 65MB hard disk, monochrome monitor, $4,295.
In Short: The Power 386 delivers top performance and intelligent design at an excellent price.

CIRCLE 447 ON READER SERVICE CARD

Benchmark Tests: Northgate Power 386 vs. Compaq Deskpro 386/20 and IBM PS/2 Model 80-111

The Northgate Power 386 holds its own against even the Compaq Deskpro 386/20 in every performance category. Despite a mediocre 27-millisecond random access speed for the hard disk, the hard disk throughput was especially impressive—with or without the disk cache invoked.

Performance Times (Times given in seconds)	NOP	80386 Instruction Mix	File Access (small record with cache)	File Access (large record with cache)
IBM PS/2 Model 80-111	1.65	3.20	36.79	6.20
Compaq Deskpro 386/20	1.65	2.90	34.14	9.34
Northgate Power 386	1.65	2.96	7.41	5.59



The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instruction in a big 128K loop.

The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The **File Access** benchmark test measures the time it takes to perform a series of disk operations: a sequential create and write of a 256K data file, a sequential read of the same file, a random write, and a random read. The first set of results reports the time required to perform the test using record lengths of 512 bytes and 4K. The second set of results is the time required to perform the same test using 16K and 32K records. The larger record sizes show how a disk will perform in loading large programs and loading and saving large data files. Higher-throughput systems such as RLL drives will show better performance in the large record test.

"Within a few days, SideKick *Plus* became even more indispensable than SideKick"

Dick Pountain, Personal Computer World

Here's what Personal Computer World had to say about SideKick® Plus:

"When the news of SideKick Plus arrived, I made up a shopping list of the improvements I would like to see ... Borland has provided all these things and much, much more."

Intelligence and elegance of design

"I discovered that the same intelligence and elegance of design that initially attracted me are still there, and certain new features like the customizable menu system represent a real breakthrough in user interface design."

Sophisticated memory management

"Memory management in SideKick Plus is so sophisticated that it almost amounts to an alternative operating system ... The amount of memory tied up is tiny (less in fact than old SideKick!) ..."

The Phonebook: Fully-featured communications

"The Phonebook has come a long way ... For one thing, it has acquired a fully featured communications package which can work in the background; you can upload and download files while continuing to work on your PC ... The Script language is one of the best I have seen."

The Notepad: Power for serious writing

"The Notepad is as powerful as many word processors ... I would happily use it for serious writing." "Up to nine notepads can be opened simultaneously with SideKick Plus."

Outlook: The best outline processor

"Outlook is ... the best outline processor I've tried, comfortably beating ThinkTank, PC-Outline, and Ready! in elegance and ease of use."

3½" and 5¼" disks included.
Hard disk required.

The File Manager: Competing with the standalones

"The File Manager ... performs a similar function to standalone utilities like Xtree, Quick DOS, or the Norton Commander, and shares features with all of them."

The Time Planner: Hugely enhanced

"The Time Planner has advanced even further than the Phonebook ... it has been designed with networking in mind."

Plus a lot more

"The enhanced cut-and-paste functions are perhaps the most attractive feature of SideKick Plus ... [it] has a powerful, consistent ability to cut-and-paste from any application to any other."
"The calculator is no longer one, but four calculators: you can switch the type to Business, Scientific, Programmer, or Formula."

Positively addicting!

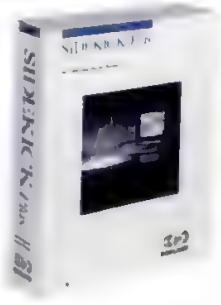
"In my view, the individual applications in SideKick Plus are of such a standard that I would be hard put to better them with a collection of standalone applications ... I remain an addict."

Excerpts from Dick Pountain's review of SideKick Plus in Personal Computer World, March 1988.

If you have the Intel® Above™Board you can load the SideKick Plus desk accessories into expanded or extended memory and leave most of your conventional memory to run your other applications.

Ask your dealer about Borland's special offer for SideKick owners.

*60-Day Money-Back Guarantee**



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BI 1227

CIRCLE 137 ON READER SERVICE CARD

Tree86: Mouse-Minded Hard Disk Organizer

PC HANDS ON

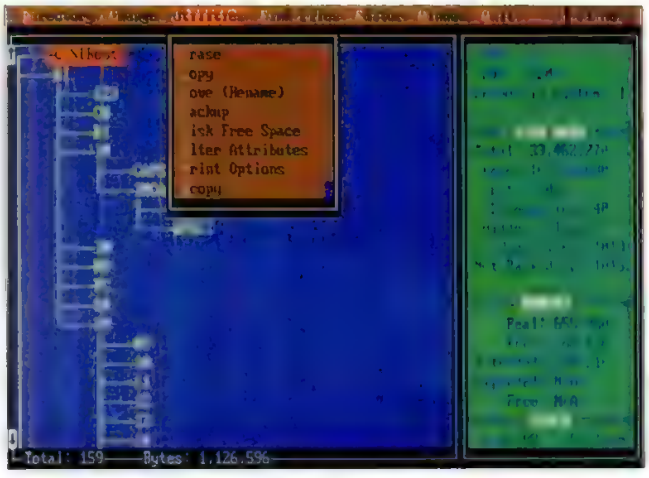
BY EDWARD L. PERRATORE

It isn't easy to top *X-Tree Pro* for a good, sleek hard disk manager. But if you want to cut costs, give your mouse some exercise, and pick up a few more features, *Tree86*, Version 2.0, is worth the climb.

At $89, The Aldridge Co.'s *Tree86* first shows a graphic-tree display of subdirectories. Pull-down menus offer DOS commands plus a few additions.

You drag the mouse to undrape various menus and then click options. A mouse isn't mandatory, but mouse support is one of *Tree86*'s best selling points.

Tree86 helps you find files using up to four parameters. You can sort files by several criteria and then reverse the order. While pointing and shooting to copy, tag, and move files, you can also view chained files by using VIEW-86.EXE.



Along with routine DOS functions, Tree86's Xcopy copies whole directories.

The Xcopy option copies files, directory structure and all, between drives. Hitting " / " toggles you into TreeDOS, a DOS-like environment with command-line editing and retrieval of previous commands.

There's more. The 140K RAM required to boot drops to as low as 80K when you run TreeDOS or a different program from *Tree86*. A configuration program enables you to set which drives to log upon entry into *Tree86*. Tree structures for each drive remain in RAM until you quit the program and can be stored on-disk for quicker logging the next day.

Tree86 rates as a good buy. For $40 less than the market leader, you get all the leader's features and more. PC

PC MAGAZINE FACT FILE

***Tree86*, Version 2.0**
The Aldridge Co.
2500 City West Blvd., # 575
Houston, TX 77042
(713) 953-1940
List Price: $89
Requires: 140K RAM for booting, one disk drive (hard disk recommended), DOS 2.0 or later (3.0 recommended).
In Short: Multiple drive logging and directory copying are among the attractive features of this mouse-driven hard disk manager. Not copy protected.

CIRCLE 434 ON READER SERVICE CARD

$90 Utility Dresses Up 9-Pin Print

PC HANDS ON

BY JONATHAN MATZKIN

There is nothing so enticing as software that tweaks extra performance out of your hardware. *The Image Printing Utilities*, from Image Computer Systems, give your 9-pin printer capabilities more characteristic of high-end dot matrix machines. The software also teaches your 9-pin a few tricks that even high-end printers can't muster.

For openers, the package lets you load up to eight high-quality fonts at once, from a selection of 16, and freely mix them within documents. The fonts can be printed with all the formatting and character attributes your word processor and printer normally provide.

The utilities package consists of two programs—*Metatext* and *ImagePrint*.

Metatext is memory resident and installs from either the command line or your AUTOEXEC.BAT file. With one or two fonts selected, the program occupies about 60K RAM. 120K RAM is required for the maximum of eight simultaneously available fonts.

A command-line switch specifies print quality for each chosen font. To achieve the highest quality, *Metatext* causes six passes of the printhead. The results rival output from some 24-pin dot matrix machines.

To switch among selected fonts, you simply insert a backslash, followed by a number corresponding to the appropriate font, into your word processor file. Underlining, boldfacing, and other character attributes are invoked as usual.

ImagePrint offers the same choice of fonts, print qualities, and attributes as *Metatext* but takes a previously created ASCII text file as input. You tell *ImagePrint* what to do with the file by embedding commands that correspond to desired fonts and attributes.

In its "typewriter mode," *ImagePrint* converts your keyboard and printer into a supercharged typewriter that would make mere mortal office machines slink away in shame.

The program opens a one-line buffer that is printed immediately when you tap Enter. Your text is displayed on-screen as you type. All of *ImagePrint*'s fonts and features are available.

The Image Printing Utilities won't magically transform your 9-pin printer into a LaserJet, and the additional head passes mean a decrease in speed and an increase in wear and tear. But the boost in print quality and versatility far outweighs these drawbacks. PC

The Image Printing Utilities *add multiple fonts to your 9-pin printer and convert your keyboard and printer into a versatile typewriter.*

```
FONT1: Cubic font
FONT2: Elite font
FONT3: Italic font
FONT4: Orator font
FONT5: Typewriter font
```

PC MAGAZINE FACT FILE

The Image Printing Utilities
Image Computer Systems
P.O. Box 647
Avon, CT 06001
(203) 678-8771
List Price: $89.95
Requires: 128K RAM, DOS 2.0 or later, printer compatible with IBM graphics printer or Epson dot matrix printer.
In Short: Inexpensive utilities that coax startling performance out of your 9-pin dot matrix printer.

CIRCLE 435 ON READER SERVICE CARD

Why Paradox 2.0 makes your network run like clockwork

Paradox® runs smoothly, intelligently and so transparently that multiple users can access the same data at the same time—without being aware of each other or getting in each other's way.

With Paradox news travels fast and it's always accurate

Paradox *automatically* updates itself with a screen-refresh that ensures that all the data is up to date and accurate all the time. Record-locking, Paradox-style, safeguards data integrity by preventing for example, two different users from making changes to the same record at the same time.

How to make your multiuser network work

To run Paradox 2.0 or the Paradox Network Pack on a network, you need:

- Novell with Novell Advanced Netware version 2.0A or higher
- 3Com 3Plus with 3Com 3+ operating system version 1.0, 1.1 or higher
- IBM Token Ring or PC Network with IBM PC Local Area Network Program version 1.12 or higher
- Torus Tapestry version 1.45 or higher
- AT&T Starlan version 1.1 or higher
- Banyan VINES version 2.10
- Other network configurations that are 100% compatible with DOS 3.1 and one of the listed networks

System Requirements for the Network Workstation

- DOS 3.1 or higher
- 640K RAM
- Any combination of hard, floppy, or no disk drives
- Compatible monochrome, color, or EGA monitor with adapter

*Customer satisfaction is our main concern. If within 60 days of purchase this product does not perform in accordance with our claims, call our customer service department, and we will arrange a refund.

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"When I saw the record-locking and autorefresh in action, I couldn't believe it. Here was a true network application, a program that can actually take advantage of a network to provide more features and functions, things that can't be done with a stand-alone PC.

Aaron Brenner, LAN Magazine

With Version 2.0, Paradox becomes a sophisticated multiuser product that boasts an impressive selection of data-production features and password-security levels.

Rusel DeMaria, PC Week"

Paradox responds instantly to "Query-by-Example"

The method you use to ask questions is called Query-by-Example. Instead of spending time figuring out *how* to do the query, you simply give Paradox an example of the results you're looking for. Paradox picks up the example and automatically seeks the fastest way of getting the answer.

Queries are flexible and interactive. And in Paradox, unlike in other databases, it's just as simple to query more than one table as it is to query one.

"The program elegantly handles all the chores of a multiuser database system with little or no effort by network users.

Mark Cook and Steve King, Data Based Advisor"

"Paradox . . . has quickly become the state-of-the-art product among PC database managers . . . Paradox still reigns supreme as the thinking user's DBMS.

Jim Seymour, PC Magazine"

You don't have to be a genius to use Paradox

Even if you're a beginner, Paradox is the only relational database manager that you can take out of the box and begin using right away.

Because Paradox is driven by the very latest in artificial intelligence technology, it does almost everything for you—except take itself out of the box. (If you've ever used 1-2-3® or dBASE,® you already know how to use Paradox. It has Lotus-like menus, and Paradox documentation includes "A Quick Guide to Paradox for Lotus Users" and "A Quick Guide to Paradox for dBASE users.") Paradox, it makes your network work.

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Hot-links documents to Lotus spreadsheets	Yes	No
Imports Lotus spreadsheets into documents for editing with fonts and enhancements	Yes	No
Number of columns per document	8	1
Runs Lotus and up to 7 programs or macros from its main menu	Yes	No
Supports Postscript	Yes	No
Date/time-stamp documents	Yes	No

*"*A lot of factors make Q&A Write ($199) the best in this group." Executive Word Processor Comparisons, John Lombardi, InfoWorld Magazine, 10/12/87, Pg. 59.* Surprised? Unfortunately, some people are. Because even though Q&A Write was rated the best executive (easy-to-use, yet powerful) word processor by both *InfoWorld* and *PC Magazine*, PFS: Professional Write continues to sell. So we've cooked up an upgrade and promotion to get the word out. And hopefully when it's finished, thoughts of PFS: Write will be too.

The first 5000 PFS: Write or PFS: Professional Write owners to rip the title page out of their manual and send it along with the coupon from this ad and a check for $29.95 get a complete Q&A Write package.

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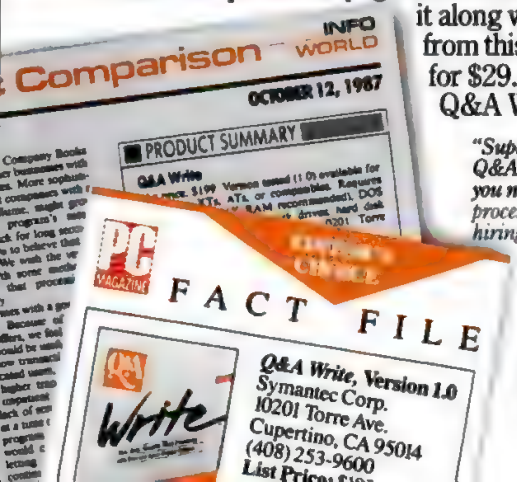
Carol Olsen Day, PC Magazine, Editor's Choice February 29, 1988



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CIRCLE 250 ON READER SERVICE CARD

PC UPDATE

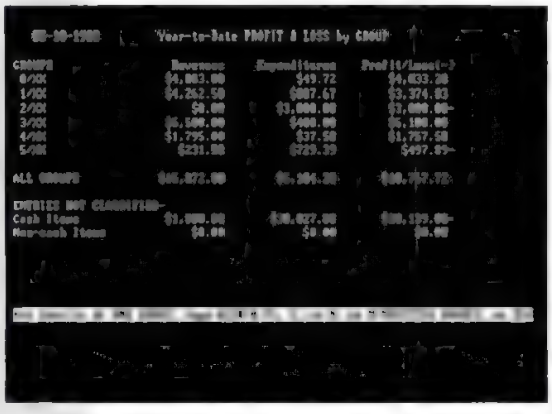
by Paula Seefeldt

Peachtree Data Query II Enhanced Uses Date Fields and Subset Databases

Peachtree Software's ***Peachtree Data Query II Enhanced*** is the latest report writer for use with the ***Peachtree Complete II*** accounting system. New features include the ability to perform arithmetic on date fields and to create subset databases. The enhanced PDQ also accepts "wildcard" matches in report selection criteria. Retail price is $199. Peachtree Software, Norcross, Ga.; (404) 564-5700.

System ABC, Version 3.2, Gains Graphic Capabilities

ABC Systems is shipping Version 3.2 of **System ABC**, a financial management package for farms and family businesses. The new release consists of two products, the ***ABC Money Manager*** and the ***ABC Net Worth MicroScope***. The *Money Manager* now replaces IRS F-schedule line numbers with user-assignable



Version 3.2 of System ABC allows a farm to record its entire history of profits and losses

equivalents. The *Net Worth* programs have been expanded to include graphics and can store a farm's complete net worth history. Version 3.1 owners may purchase both products as updates for a single fee of $35. The *Money Manager* retails for $250 and the *Net Worth MicroScope* is $40. ABC Systems Inc., Western, Nebr.; (402) 433-4801.

Micro Logic Designs Entry-Level Tornado

Micro Logic Corp. has added a ***Mini-Tornado*** software package to its product line. The scaled-down version of *Tornado* is an entry-level program that organizes bits of random information. *Mini-Tornado* stores up to 600 windows and 60,000 characters and retails for $49.95. Micro Logic Corp., Bellevue, Wash.; (206) 451-9788.

ZyINDEX Creates AutoIndexing

ZyLAB Corp. has updated its text search and retrieval program, ***ZyINDEX***. Version 3.0 adds AutoIndexing, with binary file detection and LAN capability. Updates are free to users who purchased *ZyINDEX* in 1988 and $45 for those who purchased prior to 1988, until July 15. After that date, all updates are $55. New orders are $95. ZyLAB, Arlington Heights, Ill.; (312) 632-1100.

Boston Access, Version 3.4, Uses Multiple Interfaces

Version 3.4 of ***Boston Access***, from Boston Software Systems, allows direct control of application interfaces by third-party software. Interfaces can now be developed among applications running on microcomputers, minicomputers, and mainframes without reprogramming and at a significantly reduced price. *Boston Access* 3.4 retails for $550. Boston Software Systems Inc., Sherborn, Mass.; (617) 653-5105.

Dolch Expands P.A.C. Line

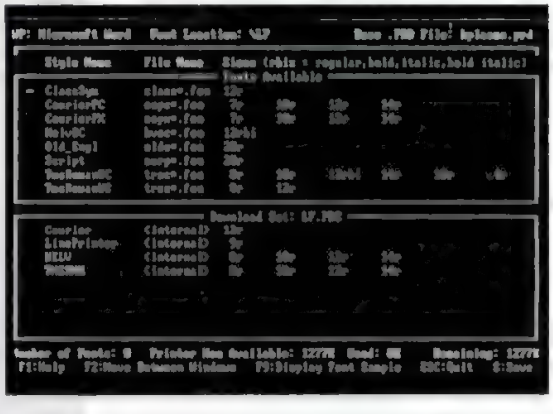
Dolch Computer Systems has incorporated RAM cache and a plasma/EGA display into the Dolch P.A.C. portable line. The 64K RAM cache, available on the 386 model, boosts memory performance. The plasma display provides high-quality screen contrast. The RAM caching option retails for $1,000 and the plasma/EGA display is $2,500. Dolch Computer Systems, San Jose, Calif.; (408) 435-1881.

Brooklyn Bridge Gains File Manager

White Crane Systems' ***The Brooklyn Bridge***, Version 2.0, has added a dual directory display manager to the file transfer utility. Other new features include a dual independent processing utility and four DOS utilities. New releases should be available this summer. Upgrades will be free to users who purchased *The Brooklyn Bridge* after May 15 and $35 for those who purchased before that date. New packages will cost $139.95. White Crane Systems Inc., Norcross, Ga.; (404) 394-3119.

Laser Fonts, Adds Menu-Driven Interface

SoftCraft is offering a new ***Laser Fonts*** package for *WordPerfect* and *Microsoft Word* users. Version 3.0 has a menu-driven user interface and comes bundled with ***Laser Graphics*** and the ***Starter Font Pack***. *Laser Fonts* allows the



Laser Fonts has added a menu driven user interface in its new Version 3.0.

user to create fonts and symbols and has a database of over 1,500 mathematical and foreign-language symbols. Updates cost $25 for registered users, with new packages retailing for $180. SoftCraft Inc., Madison, Wis.; (800) 351-0500.

Here's a radical idea: give people who work together the means to easily share information among PCs—but don't force them to become computer experts to do it.

Here's another one. Make this network so simple to install that you can set up the whole thing in oh, say, a half hour or so.

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As if all that weren't enough, TOPS runs over common twisted-pair cabling, such as regular phone wire. Just add an easy-to-install network connector—such as the TOPS TeleConnector—at each node. And at only $189 for the software, and $239 for each TOPS FlashCard, TOPS is the least expensive way to get your workgroup working together.

Of course with TOPS, PC-to-PC communication is just the beginning. Because without sacrificing simplicity, we also offer products that let you share information just as easily with other networks and systems, including Macintoshes™ and Sun® workstations.

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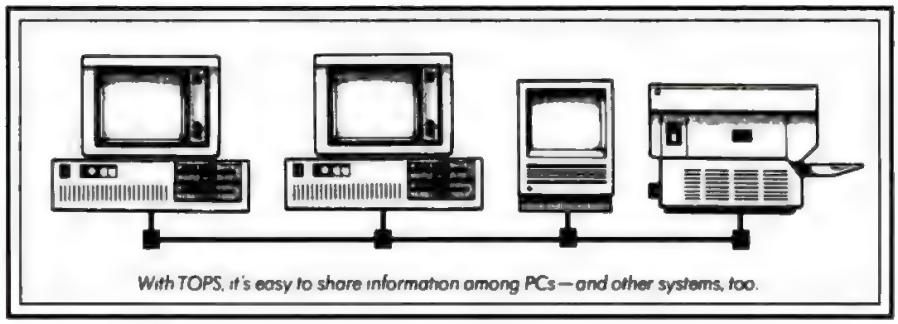


With TOPS, it's easy to share information among PCs—and other systems, too.

CIRCLE 191 ON READER SERVICE CARD

COMMUNIQUÉS

edited by Bill Howard

You Should Look It Up

"Clone manufacturers can compete with IBM in areas other than price . . . .For example . . . IBM uses a Tanden [*sic*] hyper belt-driven drive to power its machine. The Tanden drive can be noisy. When Five Star builds its clones, it installs a Fujitsu manual direct drive instead. The Fujitsu is much quieter."

—Secrets from the Underground Shopper: The Only Book to Tell You What the Retailers Won't, *by Sue Goldstein*

You Could Look It Up

"DOS: An acronym for disk operating system. It is composed of one or more diskettes on which data can be stored and one or more disk drives to read the information stored on the disks."

—*Associated Press glossary of computer terms*, Rolling Meadows *(Ill.)* Daily Herald, *March 11, 1988*

Supermini Rivals Jockey for Market Share

By GEORGE BRIGGS

BOSTON While superminicomputer vendors may have not reached a stage where they have to circle the wagons to fend off onslaughts from a variety of competing technologies, industry observers feel they will have to at least ride shotgun to protect their market share.

Supermini vendors' market share is being challenged at all levels—the high end, mid-range and low end—by super

isn't any question that some of the problems they're solving could have been done in a time-sharing environment, for example on mainframes or minicomputers," said Kerstetter.

I will absolutely give them that," the analyst said. "They're accomplishing things on high powered work stations that could only have been done on high powered minicomputers a few years ago. That's a fact of life.

Computer Systems Corp. of Littleton, Mass., Convergent Computer Corp. of Richardson, Texas, and Multiflow Computer Inc. of Bradford, Conn.

Kerstetter also said mini vendors were continually faced with an erosion of market share of their low-end offer-

But just wait till the Fruit of the Loom 386 ships. (Headline from MIS Week, *March 14, 1988)*

Child Prodigy

"Chau learned computer programming at Jackson High School as a fourth-grader and is teaching himself a complex computer language called "hexidecimal" at home. He's popular in the Unified Arts class, where he spends a good deal of time answering other students' questions about rudimentary computer functions."

—Jackson *(Miss.)* Citizen Patriot, *March 6, 1988*

Dept. of Tautology

"Postscript operates on an infinite grid. This accommodates most page sizes that would be used."

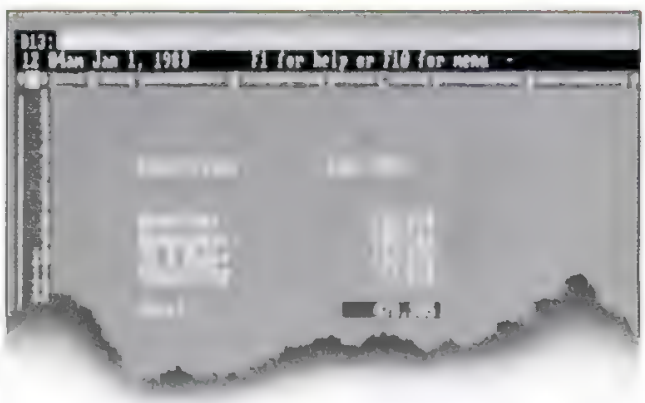
—PC Publishing, *January 1988*

Borland's Quattro Doubles In Price, but Is Still Half The Cost of Rival 1-2-3

SCOTTS VALLEY, Calif.—Borland International Inc.'s $199.95 introductory offer for its new Quattro spreadsheet is now over.

After a 90-day promotion, Quattro's price tag has been raised to $247.50, half the suggested retail price of Lotus 1-2-3, according to Robin Shepherd, a Borland spokeswoman.

New math at work? (PC Week, *March 22, 1988)*



More new math: The numbers and formula are in column C in this Lucid 3-D *advertisement, but the display (upper left) says Column D.*

Classified Intelligence

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—Atlanta Journal & Constitution, *February 7, 1988*

Computer-PC Compatible with flopping-key board printer etc. $1350

—McAllen *(Tex.)* Monitor, *February 27, 1988*

DEST Workless station Lmodel 34125 OCR, $4500.

—The Star Tribune *(St. Paul, Minn.), February 25, 1988*

Free Software—Free IBM software, choose from word processors, data bases, games, education, spread sheets, and more. Call xxx-xxxx, leave a mess.

—California Computer News *(Sacramento), February 26, 1988*

COMPUTER CBM Commander model MDL8032, dual desk with printer, all accounting program, paper clips and work PRO.

—The Ottawa Citizen, *March 1, 1988*

Dandy 1,000 with hard disc, 10 megabytes, color excellent condition.

—The San Juan Star, *February 22, 1988*

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Winners this issue: Jay Nusholtz (Supermini rivals Jockey), Thomas Mosteller (Quattro pricing), Mark Warner (Lucid 3-D), Dan Riley (Postscript), Timothy Clore (hexidecimal), Chuck Reiter (computer size), Paul Clarkson (workless station), Michael Sandberg (leave a mess), Edward Cavazos (flopping-key board), Mark Bornais (paper clips), David F. Gleason (Dandy 1,000), Doris Mulott (DOS), Luigino Mascio (hyper belt-driven drive).

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Lazerstart 2.5	71
MAC Vision 2.0	299
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Microsoft Multiplan 1.11	118
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■ BILL MACHRONE

IN YOUR (INTER)FACE

It's no wonder that this industry can't make any progress on user interfaces. All the decision makers are too busy attending one another's press conferences to get any work done.

My faith is shattered. I don't believe anybody anymore. For the price of a press conference, anyone can pull together a spec, call it a standard, and get half a dozen or more industry figures onto a podium to spout some platitudes about how it's The Way of the Future and the surefire cure for everything from the balance of payments to pattern baldness.

The software developers jump on the bandwagon with utter abandon, apparently terrified that one small change in hardware features or end-user tastes will leave them playing second fiddle. Actually, it isn't a bandwagon so much as a juggernaut, irresistibly consuming resources.

There's more at stake here than corporate pride and profitability. We're talking about the hearts and minds of developers, distribution channels, and corporations. The needs of the end user aren't an issue, even though end-user computing is supposedly what this is all about. This weird, interlocking network of "You tout my product and I'll tout yours" is a drain on the essential energy of our industry. The trade press goes galloping off over this hill and that, in pursuit of the latest strategic alliance, while end users just get confused. And when they get confused they tend to do nothing until they get unconfused. Thus, they don't buy into the very technologies being hyped.

Here's a brief rundown of the hoops that software developers have had to jump through of late:

OS/2 Just when everyone was getting happy with DOS, along comes OS/2. The combatants had finally gotten the EMS spec squared away and the old 32MB volume limit was about to become history. After reading enough *PC Magazine* articles, anybody could write a well-behaved TSR program. Then Microsoft and IBM tell us DOS was never very good anyway. I believed. I still believe. The richness of OS/2's calls and the prospect of multithreading and multitasking are enough to turn me away from the safe, well-known world of DOS. The cost to developers is enormous, but they can pull it off if they're not distracted.

Presentation Manager The Presentation Manager is a different story. While the Macintosh was proving that bitmapped is better, the EGA was proving that color is better. The two merged in *Microsoft Windows*, which was too memory-constrained and processor-bound to make an appreciable dent. At the same time, IBM was shopping for a universal user interface to tie its disparate and incompatible product lines together. The result was Presentation Manager. Never mind that the beta version of the developer's kit just shipped. Or that all the *Windows* code that developers wrote doesn't port over. They lined up dutifully on the podium.

OS/2 LAN Manager The OS/2 LAN Manager is a multiuser operating system in drag. Microsoft hopes that IBM will adopt some or all of it into its networking scheme, but IBM is playing coy. The guys on the podium were on a first-name basis by this time.

Macintosh Suddenly, to be considered a serious player you've got to support Macintosh, too. The audiences at the Mac II press conferences and shows, however, have their own heroes. The dutiful minions of DOS are shown the respect and attention normally accorded to the family dog.

New Wave New Wave is Hewlett-Packard's answer to the Macintosh. In fact, it out-Macs the Mac. The Apple folks are gnashing their teeth and firing off lawsuits over its look and the way it synchronizes tasks that know nothing about one another. It shows you what you can do with a dream and 300 person-years of programming time. It runs under *Windows* today, Presentation Manager tomorrow. There's just this one little problem. It's different. New Wave's benefits aren't free—they require substantial reprogramming of *Windows* applications to harness them. Yet the band played on, praises and promises flew from the podium, and R&D dollars were committed.

Unix Unix is the newest old hoop to

Illustration: Cathie Bleck

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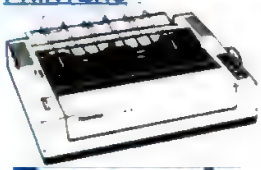

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■ **BILL MACHRONE**

jump through. Ashton-Tate, WordPerfect, and a few others have maintained terminal-based versions of their products so they could have a toehold in the multiuser environment. By and large, however, the products worked and looked far better on their native DOS machines. Yet the usual CEOs could be counted on to trundle out to any introduction of a new Unix machines and speak in glowing generalities about its bright and unlimited future.

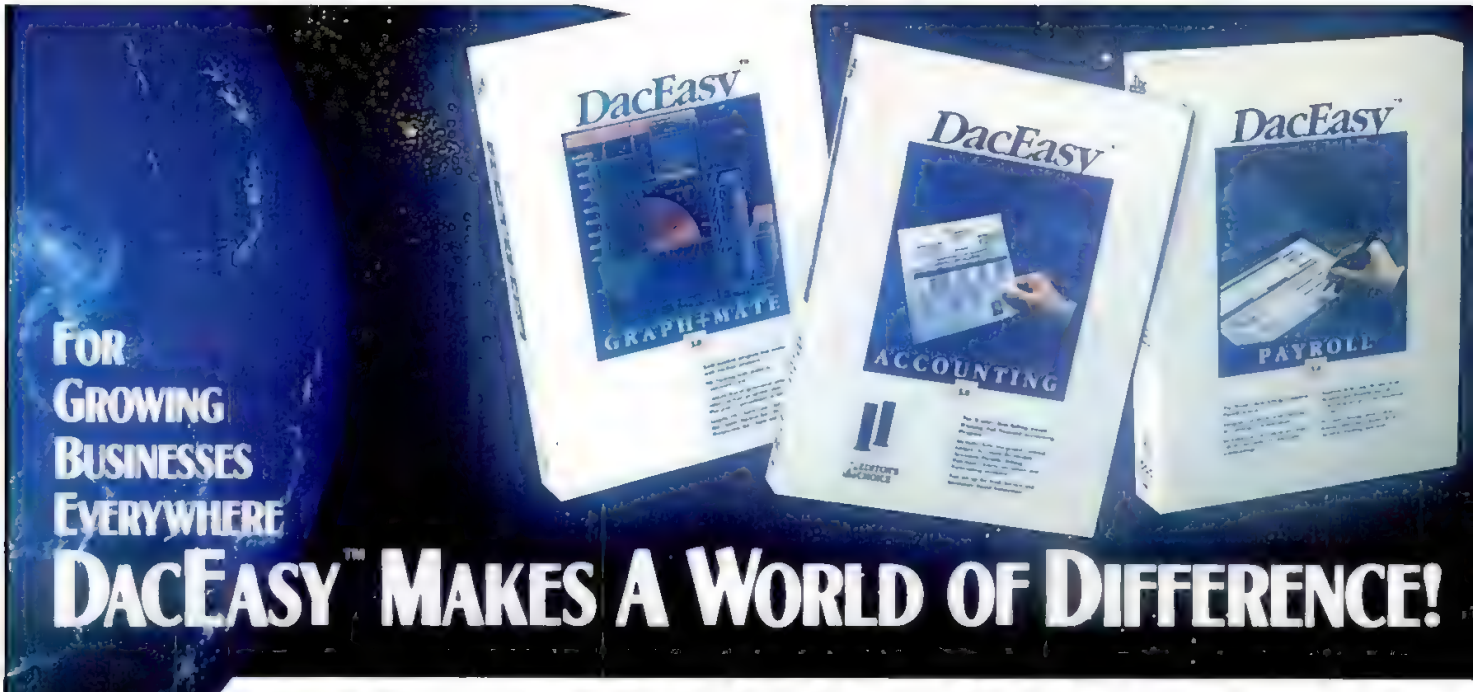
Open Look Heyyy, up! March to that podium, boys, and tell 'em how the future depends on this amalgam of AT&T, Sun, and Xerox technology running on $20,000 workstations under Unix. This user interface is spectacularly good, but it runs on the tail, not the dog. It also lacks the participation of several major workstation vendors. Sun likes to smile and shake its head, saying, "Poor DEC. Poor HP. Poor IBM. They just don't understand." Right.

Needless to say, there are countless others. No hardware manufacturer rolls out a new machine today without a gaggle of software manufacturers on hand to testify to its engineering genius and perspicacity in producing this machine. Of course, much of this is an endless dance to maintain a high level of awareness in the investment community. At the podium, the CEOs become like talk-show guests, famous for a Warholesque 15 minutes, or, like latter-day Rula Lenskas and Zsa Zsas, famous just for being famous.

Worse, they seldom have anything intelligent to say about the product at hand, preferring instead to throw a few well-aimed jabs at their perceived enemies and competitors, who may also be on the podium. Every once in a while, however, they actually commit to producing hardware or software or whatever, something that's actually going to be compatible with the new wonder gadget of the day. Then you have to ask yourself how deep their resources really are.

Face it. The next version of the software you count on most is probably late. A major reason it's late is divided resources, and the rest is deep-seated confusion over standards.

Maybe we could make some progress if all the CEOs stayed home for 6 months and declared a moratorium on endorsements.



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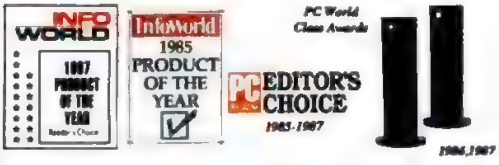

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CIRCLE 134 ON READER SERVICE CARD

■ JOHN C. DVORAK

CONFESSIONS OF A POWER USER

As part of his therapy, a reformed John C. Dvorak recounts a time in his life when fast was never fast enough, and the search for speed became an overpowering obsession.

It's hard to explain this feeling of illease. It's called Poweruseritis. It can happen to anyone, though some doctors say it's genetic. Indeed, some people *do* seem predisposed. It wrecks careers. It ruins relationships. And all in all, it turns into a futile exercise in silliness. It struck me last year and I'm still getting over its effects. I may never fully recover.

HOT-ROD REVERIE It began when I decided that a PC AT wasn't good enough. What would it be like, I asked myself, if I had the fastest desktop micro I could piece together? A hot-rod machine. The fastest hard disk, the fastest graphics card, the fastest processor. Michael Dell told me to just use his latest 386: it would be fastest all around. Other vendors said they had this and they had that—all of which were the fastest this and that ever. "You'd better hurry up," said one vendor, "tech writer Steve Satchell is putting together a hot-rod machine too." Not understanding the ill effects of Poweruseritis, which had apparently struck me, I figured he was out to personally embarrass me and my slower machine. There must be others, I surmised. I wrung my hands in a frenzy of paranoia.

Pretty soon it became obvious that no hot-rod machine will be the fastest thing in town for more than a month. Every vendor says it has "something" in the works that will be out next month. As time went by I heard that columnist Jerry Pournelle was trying to piece together a hot-rod machine. Oh no!

I made some calls. Suddenly I was inundated with speed burners. My office was full of them. The Compaq 386, the SIA, the VIP, clones galore. I couldn't ship them back fast enough. At one time I must have had 100 mips (million instructions per second) stacked around the desk. I developed the jitters.

I finally settled on Steve Hui's Everex 20-MHz 386 machine, which just blew all my benchmark tests right off the scale. I equipped it with an OMTI ESDI controller from Scientific Micro Systems, a Control Data Wren drive, a 16-bit Compaq VGA card, and a 9,600-bit-per-second modem. It had to be faster than anything else around, running at close to 5 mips. Hooked up to a Zenith flat-screen monitor, it was a pretty impressive *WordStar* engine. With three different on-line thesauri and 19 TSR utilities I could compute up a real storm. Let's see anybody beat this, I mumbled. The backs of my hands began to itch incessantly.

Illustration: Cathie Block

Then the irony. My thirst for speed had barely been quenched when Steve Hui at Everex said that he would swap out my 20-MHz 386 for a 25-MHz 386 the minute they got some 25-MHz chips from Intel. It should add at least another mip or two, he said. My mouth twitched as I let out a maniacal laugh that echoed in the hallways. I grabbed Hui by the collar: "Nothing can stop me NOW! Hahahahaha!"

POWER USER DETOX That's all I remember. I woke up in a hospital room in the Don Tarbell Clinic. In something of a daze I was slowly weaned off my addiction. At first they'd let me use the Everex at full speed, then they cut the clock speed down further and further until I could eventually be moved to a 6-MHz AT and finally to an IBM PC-XT with a 10MB hard disk. I was reacquainted with an Apple II, an old Commodore PET, and a couple of handmade machines using chips long forgotten. They are my friends. I even loaded a couple of cassette tapes into them. It took a couple of tries.

I left the clinic a few weeks ago, calm, refreshed, and with a brighter outlook on life. I now see that normal people do get true functionality from an IBM PC-XT or an Apple II.

They aren't "idiots who can't keep up the pace," like I used to think. I just have to remember what I was taught at the clinic and what I say in front of my regular weekly group: "I am a Power User. Forgive me. As a recovering Power User, I now know I can fight this disease." Then I drive home in my Nash Metropolitan.

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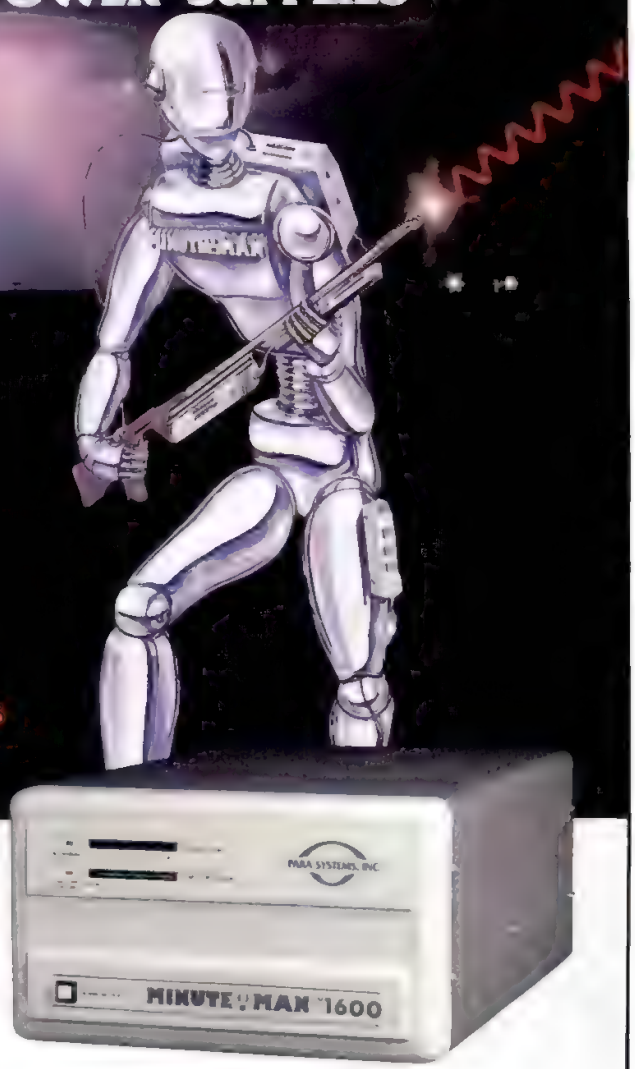

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CIRCLE 381 ON READER SERVICE CARD

■ JOHN C. DVORAK

INSIDE TRACK

Action at Lotus abounds as employees sell off stock; Release 3.0 of 1-2-3 delayed. Coincidence?

The industry is abuzz over the sell-off of Lotus stock last February by many of its top executives. If all the facts are correct, there are more than a few interesting observations to be made. First off, who sold what? Jim Manzi, the president, sold nearly 30 percent of his holdings, vice president Palmer True sold 99 percent of his holdings, and Susan Yeomans, another VP, sold 96 percent of her holdings. Edward Belove, VP, sold 100 percent of his holdings and Dan McMillan sold 98 percent of his holdings. I could go on. **Over $15 million worth of Lotus stock was dumped, er, sold.** That was all in February. On March 23, the company announced it would delay the release of Version 3.0 of *1-2-3* for at least 6 months. The stock took a dive.

The SEC supposedly is looking into this, but Lotus people say the sell-off and subsequent announcements were **a coincidence.** According to one report all this was just a lot of previously executed stock options being sold off for one reason or another. Lotus general counsel Tom Lemberg was quoted as saying that the officers who sold the stock in February **"had no way of knowing that release 3.0 would be delayed in March."** OK, let's give them the benefit of the doubt and believe that assertion.

If that assertion is true, then you have to wonder **what the heck is going on** at Lotus if the progress of its number-one priority project isn't being monitored by the executives who run the company. What are they doing with their time? You also have to wonder what kind of confidence they have in the future to be selling off their stock so **enthusiastically.** I'm sure this activity pleases Messrs. William Gates III and Philippe "Genghis" Kahn to no end as sales of *Excel* and *Quattro* boom. Once again, it's starting to look like **a new ball game** is emerging in the spreadsheet arena. Remember a company called VisiCorp?

Trying to Cheat Reality Dept.: Recently I got hold of an Atari Mega4. It's the newest version of the 68000-based ST series, but with 4MB RAM. I was sent a program called *PC-Ditto* from Avant-Garde Systems in Jacksonville, Florida. *PC-Ditto* is a software emulator that tells the 16-MHz 68000 chip inside the Mega4 to emulate the 8086's instruction set. **I was shocked** to discover that it worked. Once installed I could shove a DOS diskette into the Atari, boot MS-DOS, and run most PC applications. I noticed, though, the applications ran (putting it mildly) **sluggishly.** So I ran the PC Labs benchmark tests and other test programs on the machine. Most tests saw the emulator as a virtual machine and gave me an accurate indication of its speed as a PC clone. **It was terrible.** It ran at 1/5 the speed of an already **lethargic** old 4.77-MHz PC-XT. Man, that's slow! Assuming that the 68000 clicking along at 16 MHz is at least as powerful as an 8-MHz 80286 machine, this means that the emulator saps the power of the chip by a factor of about 20 to 1 depending on how you calculate these things. That means the machine is effectively running at 5 percent of its power.

It's hard to tell if the Avant-Garde 95-percent power drain is good or bad. In the past we've not seen emulators for the simple reason that they are **so slow** that vendors won't release them. For all I know, the Avant-Garde software is a screamer. The only other emulators I've played with emulated 6502 code on a Macintosh. No benchmark tests were available to test their efficiency.

This interests me because **emulation is the key** to the potential sales of RISC-based microcomputers in our computer marketplace. If some new cure-all RISC chip claims to be a 10-mips chip, it will be sold as having twice the power of a 24-MHz 80386 chip. This may be meaningless if under 8086 emulation it runs at 5-percent power or .5 mips—the speed of a turbo XT. **This isn't progress, it's marketing.** Get those benchmark test disks out and keep them handy.

While on the subject of marketing. Half of 1987 and most of 1988 has been spent discussing two standard bus architectures: the old PC bus and the Micro Channel or MCA bus. The **current consensus** is that both will live forever and nobody really cares about the MCA bus. The only big-time booster for the MCA bus has been our editor-in-chief and publisher, Bill Machrone, who, because he likes most things that are nifty and new, **was largely ignored.** I've watched this debate from the sidelines, but I see the same old trend. Nobody shows any interest at first, then it's like the formation of a crystal in a chem lab beaker: once a seed is dropped into the liquid, everything changes instantly. The seed, in this case, is Tandy's announcement of an MCA bus. I figure that by this time next year we'll be talking about the old bus in terms of how long it has to live. "A week? Maybe two?" When the market **starts to slide,** you watch them **bail out** of that old bus as fast as they can.

Final Note Dept.: I finally got to play with **HP's New Wave** graphical interface for the IBM PC. While it may never see the light of day if Apple has its way, let me compliment the programmers at HP for turning the *Windows Executive* into a work of art. This interface is what it's all about. While the metaphor could have been a little less like a Mac copy, the implementation is **spectacular.** It's worth the effort to find someone who can give you a demonstration. PC

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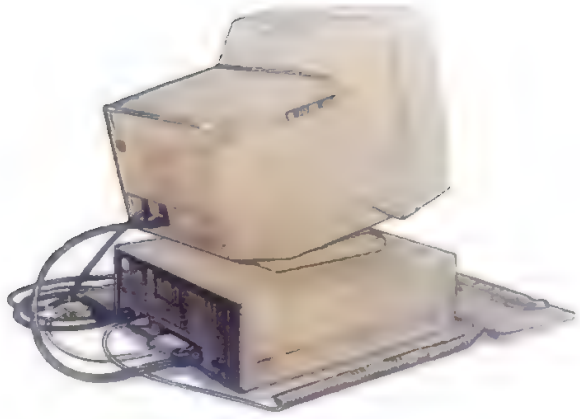

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CIRCLE 278 ON READER SERVICE CARD

■ JIM SEYMOUR

386 PCs: REDEFINING THE WORKSTATION

With bigger and better monitors, faster and larger hard disks, and simplified networking capabilities, 80386-based PCs stand a good chance of being the workstations of the future.

Sometimes change sneaks up quietly, gradually taking over and, without our noticing, modifying fundamental aspects of the way we work and the form and function of the tools we use. And sometimes change jumps out of the shadows and bops you on the head, mugging you and altering your life before you realize what's happened.

Both models of change have been at work in the PC business. The rapid *workstationization* of personal computers that has been happening with a quiet inevitability is now coming in a sudden rush.

The April release of Sun's new 386i series hybrid PC/workstation underscored the trend. But the movement was under way long before Sun rolled out the BMW soundalikes.

The term "technical workstation" has been as loosely defined as any in computing. But over the past couple of years, a consensus has formed about what a workstation is and how it differs from a PC.

That emerging definition of a workstation includes a large, high-resolution monitor with graphical displays under a windowing system; a fast, powerful 32-bit microprocessor; at least 2 to 4MB of RAM installed (with the potential to add at least 8 to 16MB more), a fast, large-capacity hard disk; the ability to run the Unix operating system; and the capability to make networking easy, probably by including built-in network connections for a widely used standard such as Ethernet.

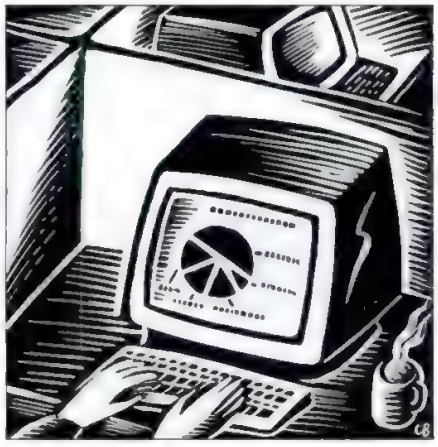
Does that sound . . . ummm . . . a bit familiar? Like maybe today's 80386-based personal computers?

CHALLENGING THE MYSTIQUE

The workstation mystique has endured, no matter how well 386-equipped PCs measure up. But look for a moment at just how well the current crop of high-end 386s meet that workstation definition:

■ There's a clear move toward larger, higher-resolution displays for high-end PCs—though for now we've unfortunately stalled out on the so-so Video Graphics Array standard. IBM's new larger, higher-resolution 8514 display will be the next benchmark in display quality. At $3,000 for the 8514 display and card, it's too expensive to really become a standard, but it will get a lot of attention and accelerate the trend toward bigger, better monitors.

■ A bigger character-only display would be a waste, so a graphical standard for that display is equally important. *Windows* 2.0 and *Windows/386* provide that windowing-display glue. The Presentation Manager in OS/2, Version 1.1, will extend that standard's franchise, despite the stink bombs dropped by Apple's suit against Microsoft and Hewlett-Packard—and implicitly against IBM—over the look and feel of *Windows*.



■ The Intel 32-bit 80386 chip found in current high-end PCs is giving Motorola's 68000-series microprocessors (the dominant choice for workstations) a run for the money. Vendors are supporting the Intel chip with only 1 or 2MB of RAM in base-price configurations, but that's largely a function of the artificially skewed DRAM memory-chip prices we're seeing. Most 386 PCs accept several megabytes of RAM on their motherboards, and all accept substantial additional doses of RAM on plug-in memory cards.

■ Almost every 386 PC is now offered with a large, fast hard-disk option. The 130–150MB CDC Wrens with their sub-20-millisecond access times, supported by ESDI interfaces, are popular choices, and they outperform the kinds of hard disks previously seen as standard for workstations.

■ The Santa Cruz Operation's Xenix, plus Unix products from Interactive Systems, Locus Computing, and others, have become well-respected, widely available operating systems for 386 PCs.

■ And while network connectors built into PCs remain rare birds, the proliferation of plug-in network cards that support every possible protocol and wiring scheme makes networking easier and more versatile with PCs than with most workstations.

Does this mean PCs have turned into workstations? And does that matter?

Illustration: Cathie Block

■ **JIM SEYMOUR**

It matters a great deal. And not just because, as the cynics will note, workstation-level PCs run $10,000 and more, while good, fully equipped AT-based clones have fallen below the $2,000 level.

Until now, the differences in power and function between PCs and workstations forced us to adopt either a sloppy myth or a sloppy desktop. The sloppy myth was that people who needed and used workstations did nothing but technical computing all day long and had little need of other functions.

The alternative—the sloppy desktop—reflected the reality that people who do technical computing do *many* kinds of work, much of it better handled by MS-DOS productivity programs . . . and so they plopped a PC down on their desks next to the workstation.

Apple has made much of the discovery

■ Apple has made much of the discovery that engineers also write letters and use spreadsheets, hyping the Macintosh II as an all-purpose workstation.

that engineers write letters and use spreadsheets, hyping the Macintosh II as an all-purpose workstation. In truth, the Mac II's a little underpowered as a Unix-driven technical workstation, though it's a lovely productivity machine. But high-end 20-MHz 386 PCs from IBM, Compaq, Dell, ALR, and others make very good dual-purpose DOS/Unix workstations. The new Sun 386i goes a step further.

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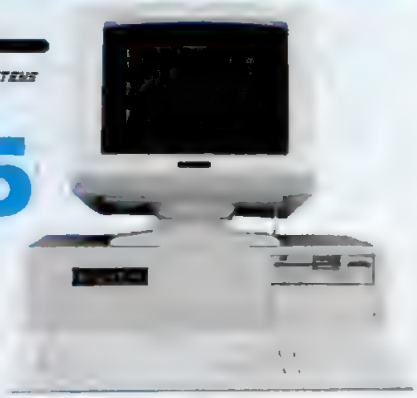

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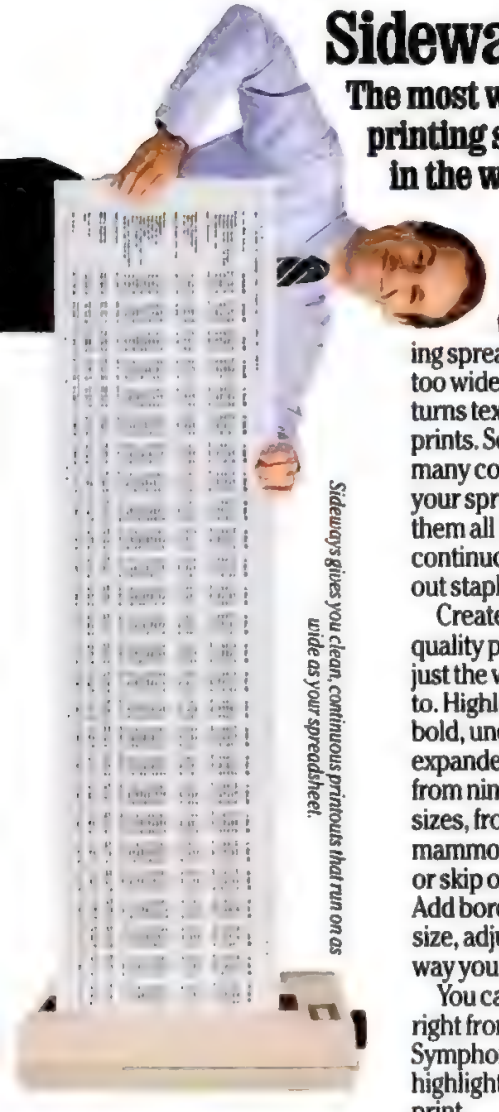

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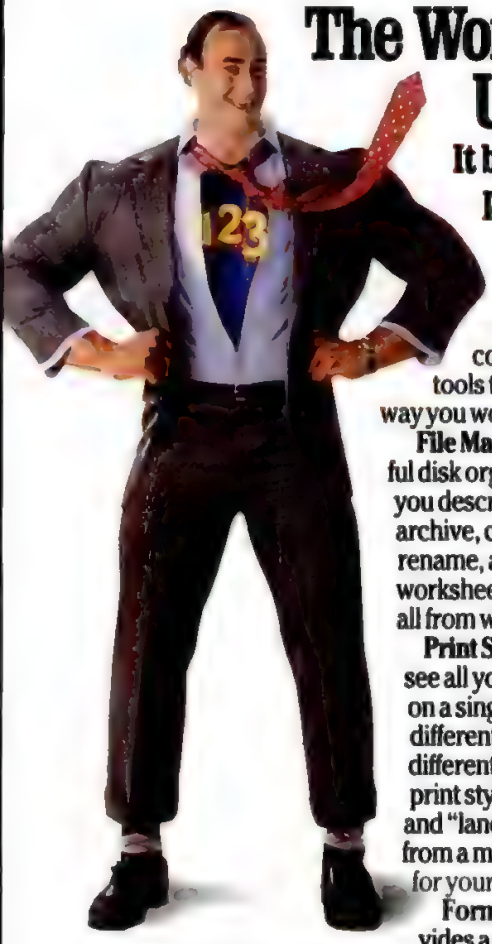

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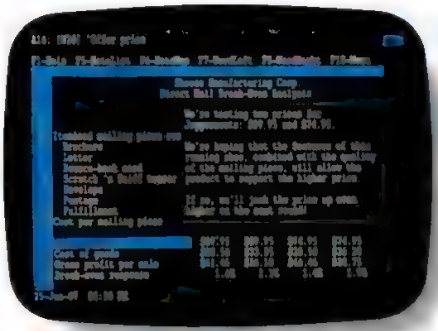

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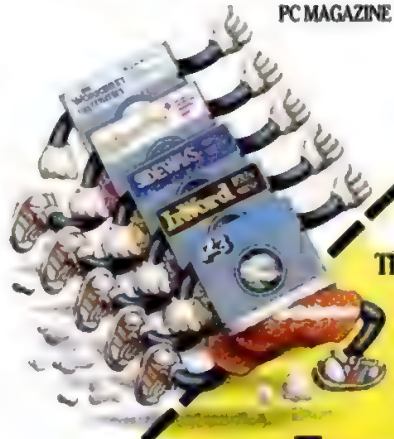

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EXTENSION COURSE: FILENAMES FOR THE FUTURE

33RDAND.LEX? POWER.USR? WHATSTHE.DIF? Some claim the DOS file system is woefully inadequate and hopelessly out of date. But old habits die hard . . .

Half the PC users on the planet whine and moan about how you can call Macintosh files anything you want from "Nasty Letter About Morton Downey" to "My Soothing Windham Hill Collection," while the IBM world is stuck with names like GEEK4.YUK and WINSTON3.AAH. But Joe Astute, my source who wears those "Get OSsified" T-shirts, tells me help is on the way. It's a fairly low priority until Presentation Manager rolls out the door with fewer bugs than a recumbent elephant, but OS/2 will one day include a real file system on top of the toy one we've got now.

But hey, after years of doing things one way, do you toss cherished customs out the window? Do you fiddle with the strike zone? Do you change the balk rule? What's wrong with tradition, anyway? DOS filename rules are part of our computer heritage, a precious legacy from CP/M. Must we throw these lovable babies out with the dirty DOS bathwater?

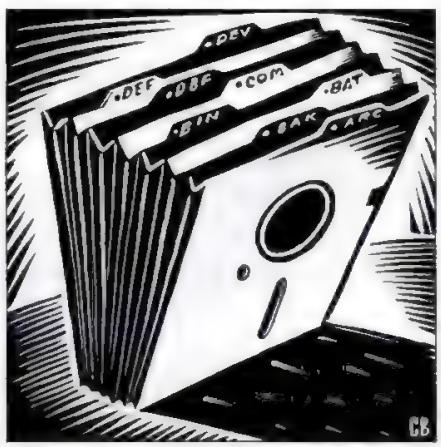
I think not. Fortunately for those of us who care about our roots, a certain computer company has given our cause a boost. By copyrighting the use of descriptive filenames anyone can understand, it has precluded their use by anyone unwilling to pay a license fee of a dollar a filename (before quantity discounts)—thereby throwing a monkey wrench into the OS/2 scheme. Fortunately, an even bigger computer company has proposed an entirely new way of looking at eight-dot-three filenames—one that will work fine with OS/2 and yet maintain compatibility with the DOS we know and love.

FOLLOW THE DOT I refer, of course, to the Strongly Typed International Filename Format 8.3 (STIFF 8.3), which was developed years ago but never implemented. Fully SAA-, SNA-, LU 6.2-, OS/2-, DOS-, and cable-compatible, STIFF 8.3 lays down precise rules for filename extensions, thereby letting all users instantly and precisely determine what kind of data is in a file merely by perusing the three characters that follow the dot.

Earlier versions of the STIFF protocol were hampered by being out of touch with DOS reality. The key to the widespread acceptance of the newly revised STIFF 8.3 is that it recognizes and locks in forever such accepted DOS filename extension conventions as these:

.ARC File compressed to avoid your wasting 40 days and 40 nights transmitting or using it.

.BAK A protective file destined for deletion before you really need it.



.BAT Telltale hidden file cleverly created by baseball game to let the boss know you were playing when you should have been working.

.BIN File created by wine list program; bad years are deleted automatically by system.

.COM A "Common" program file that can actually fit into 64K of memory and is therefore offered at a bargain price.

.DBF "Debased" file; contains only corrupted information.

.DEF A system warning that the disk it appears on is defective.

.DEV File containing satanic cult messages that can hold your hard disk in thrall.

.DOC "Eliza" program to diagnose and cure associated software when it behaves erratically.

.DYN *Lotus 1-2-3* template for creating personal ratings of fine restaurants.

.EXE A fancy "executive" program virtually unlimited in size and therefore commanding hundreds of dollars more than the "common" one that does the same thing.

.HEX Another one of those devil-worshiping viruses likely to screw up your hard disk.

.HLP A file begging to be put out of its misery.

.INC File containing sensitive encrypted corporate data.

.INI Filetype used exclusively with programs that employ "spaghetti code"; for example, CAPELL.INI, TORTELL.INI, LINGU.INI.

.INX Configuration file specifying what color pens a plotter should use.

Illustration: Carlie Bleck

■ STEPHEN MANES

.KEY The password that opens the gates to all your other files. (Under STIFF 8.3, this must be kept in the root directory to obviate user forgetfulness.)

.LBR "Labor" program file that can clash severely with .EXE files.

.LIB File converting offensively chauvinistic "sexist" language to "non-sexist" terminology.

.LOG File that produces an essential part of the Frogger game display.

.MAC A special form of .INI files.

.ME A file containing absolutely essential last-minute instructions no one bothers to read.

.MSG A file that can produce terrible headaches for many users; delete if you're sensitive.

.OBJ "Objection" file; includes a vast variety of complaints about the bugs in a particular program.

.OVR Self-modified file signifying that its useful life is "over" and therefore ripe for deletion.

.PRN File containing highly charged sexual imagery; keep away from children.

.RPT "Repeat" file that contains a boring version of information duplicated elsewhere.

.SCR "Screw-up" file reporting program problems.

.STY File included with application software by certain disgruntled programmers to secretly indicate that the accompanying program is a real pig.

.SYN File that works insidiously in tandem with .DEV files to trash your hard disk.

.SYS File requiring knowledge of secret password to display covert feminist message.

.WK1 Spreadsheet template that works just once.

.WKS Spreadsheet template that works some of the time.

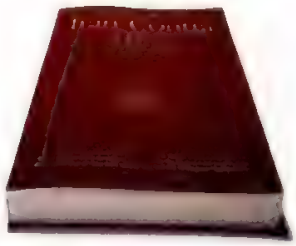
.007 File created from lost clusters; reconstructing it requires the espionage talents of James Bond.

.$$$ File indicating a programmer's engagement in wishful thinking.

I wish I had space to list all the wonderful new filetypes designated under STIFF 8.3. If you can think of it, there's an extension for it. Early-childhood programs? Use .GOO. Expense account data? An obvious .LIE. There's even .DIM—expressly for articles daring to poke fun at a certain large computer company.

And there's no doubt in my mind: STIFF 8.3 will instantly become the all-encompassing industry standard. Ignore all those pundits who keep predicting great things for the nine-character-dot-four-character or even wilder formats. Believe me: such things are about as likely as lights in Wrigley Field.

The United States Senate Used askSam To Manage Every Word Of The Iran-Contra Hearings.



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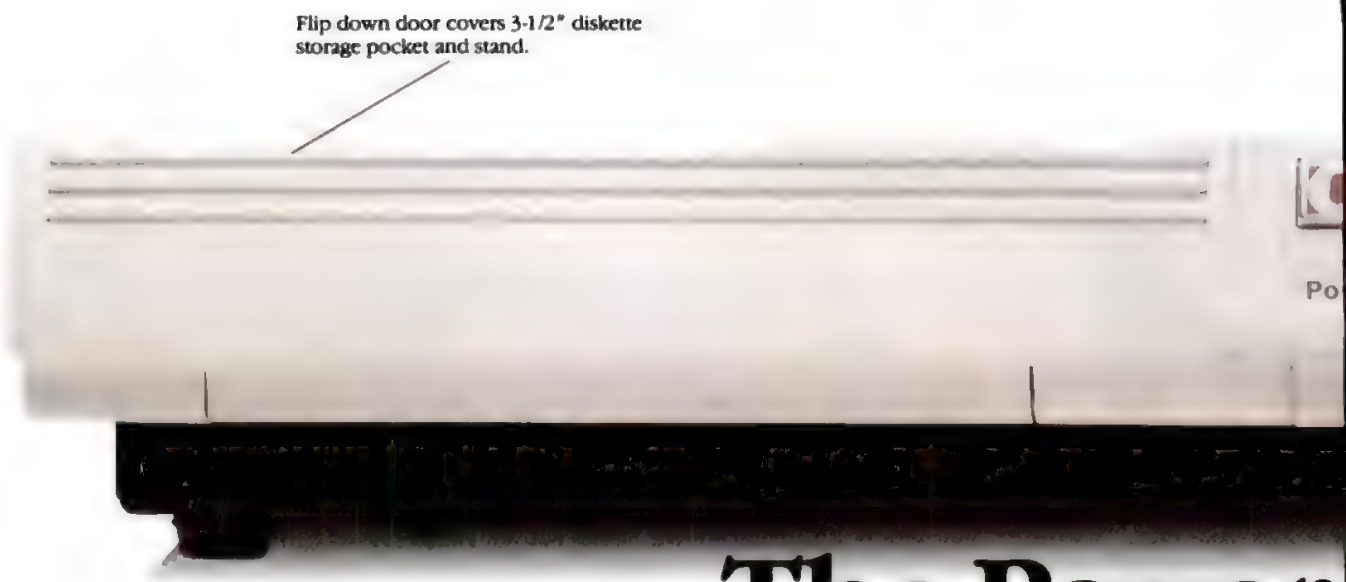

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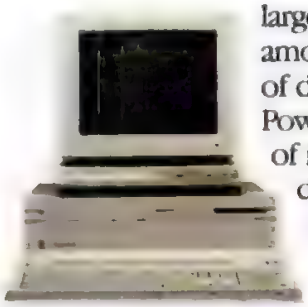

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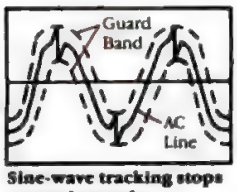

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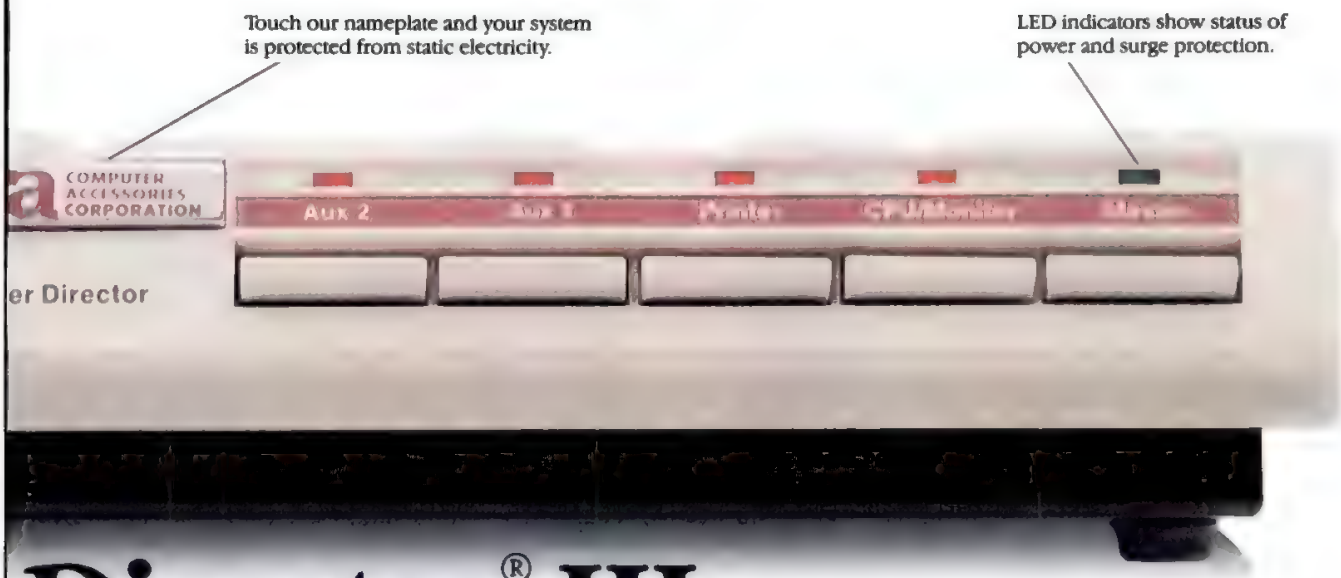

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NEARING PERFECTION

VGA BOARDS ENTER the MAINSTREAM

Until a few months ago, getting true VGA graphics meant biting not just a budgetary bullet but an entire artillery shell and buying a Micro Channel PS/2. The only alternative, trying to upgrade a PC, XT, or AT to the new video standard, was chancy at best. The first crop of VGA video adapters for the PC family failed to guarantee completely interchangeable functionality with the new IBM standard because those boards embodied only BIOS compatibility. That is, they recognized the same machine language instructions that were used by the PS/2 VGA BIOS, but their circuitry was quite unlike that of the IBM product. While they promised the same resolution and color capabilities as the IBM VGA system, when programs dipped below the BIOS to take direct control of the hardware, the early adapters could miss their cues.

The nine new video adapters from Everex, Intelligent Data Systems, Orchid Technology, Paradise Systems, Sigma Designs, Tatung, Taxan, Tecmar, and Video Seven examined here show the next step in bringing the VGA standard to PCs, XTs, and ATs: register compatibility. Not only do these video boards know and understand all of the IBM BIOS commands, but they can also be controlled at the hardware level through their registers. (A register is a special kind of silicon storage that allows video chips, microprocessors, and the like to remember numbers and settings during their calculations.) Register compatibility means that your software can bypass the BIOS to take direct control of certain hardware facilities of the VGA board. The advantage of register compatibility is that it lets your program skip the BIOS routines and the overhead they impose, thus bringing improved performance—snaz-

Even if your budget precludes the purchase of a new PS/2, you needn't be stuck with last year's video technology. With any one of these low-cost VGA boards, you'll get the most dazzling colors and highest resolution yet available.

zier colors, new video modes with more characters on the screen, faster text and graphic displays, smooth dot-by-dot scrolling—to software that takes advantage of them.

More than that, many of these video adapters promise better-than-VGA performance. Some offer 1,000-line-plus resolution; many multiply the color selection available at higher resolutions. They bring the best video yet to your PC's screen. Of course, you'll need special software drivers (which may support a limited array of programs) and a MultiSync-style monitor to take advantage of many of these super-resolution modes.

Besides the nine boards reviewed here, two other products claim hardware compatibility with the VGA standard: Compaq Computer Corp.'s Video Graphics Controller Board ($599), and IBM's PS/2 Display Adapter ($595). Both were reviewed in "VGA Compatibles: Gaining on the New Standard" in the February 16, 1988, issue of *PC Magazine*, in which the Compaq board, with its 16-bit bus interface and fastest memory access speed, was chosen as Editor's Choice.

TWIN TRENDS Take a close look at these nine boards, and you'll see two trends emerging in VGA design. Some engineers are attempting to craft exact clones of the IBM VGA products, alike in all details and capabilities, and limiting their use solely to VGA and VGA-compatible MultiSync-style monitors. Others are aiming at the universal, endowing their products with the ability to plug into nearly any standard display.

The former adapters presume you'll never want to use anything less than a 31.5-kHz fixed-frequency VGA monitor. The latter boards let you get VGA compatibility today without forcing you to buy a VGA display; these adapters will work with whatever monitor you have. Later, as your budget allows, you can upgrade your display without tossing out your video board.

The supported standards include the one used by the IBM Monochrome Display Adapter (MDA), the Color/Graphics Adapter (CGA), the Hercules Graphics Adapter, the Modified CGA capabilities of the PS/2 Models 25 and 30 (MCGA), and the Enhanced Graphics Adapter (EGA). None of these video adapters support composite input monitors: those using RCA-style connectors and having limited bandwidth. There are distinct differences, however, among the downward compatibilities of the VGA boards that support many standards. Some are only BIOS-compatible with earlier video standards, while others are register-level-compatible with them.

The unexpected downside to these backward-compatible boards is that, with the exception of the Sigma Designs VGA/H, they lack one essential ingredient of true VGA hardware compatibility: precise plug compatibility with the IBM VGA Video Feature Connector, the promised gateway to as-yet unnamed, unannounced, and unspecified add-on IBM accessories.

Nothing about these backward-compatible boards precludes the use of an IBM-style VGA Video Feature Connector. The omission is probably partly coincidental and partly because many engineers chose to offer EGA-style expansion for compatibility with existing (rather than ethereal) enhancements.

While the IBM-clone VGA boards generally give you just one connector—a DB-15 that matches the jack on the back of the PS/2—the backward-compatible VGA boards give you two. Like the other boards, they include a DB-15 that supplies analog signals to match VGA-style monitors and a DB-9 with digital signals to fit the previous standards. When you have your choice, for instance, with a MultiSync-style display that supports both analog and digital inputs, choose the former. IBM digital interfaces restrict your color choices to 64, while analog signals can put a virtually unlimited spectrum on the screen.

BETTER THAN EVER Each of these VGA adapters represents a substantial engineering achievement, notwithstanding its falling short of perfect VGA compatibility. All will bring more colors and sharper images to your PC, better than any previous video standard. Although you might still find minor compatibility problems, most of these boards should perform flawlessly with nearly all available VGA software. And with any one of them you won't have to put your PC out to pasture to see real VGA greens.

EVEREX SYSTEMS INC.

Everex EVGA

With its EVGA board, Everex pushes the maximum resolution you can expect from your MultiSync-style monitor up to an almost unbelievably sharp 1,280 by 600 pixels in four colors, without sacrificing VGA hardware compatibility. In addition, the $399 EVGA delivers backward compatibility with all standard video modes, including Hercules Graphics, and all standard monitor types. The EVGA will even drive two monitors simultaneously, albeit with the same image.

Fitting all those features takes a lot of logic. Mixed among the 13.3-inch EVGA card's DIP logic chips are four major VLSI chips, all Everex proprietary products, an Inmos DAC, and 256K of 100-nanosecond RAM.

TWO MONITORS Both analog/digital DB-9 and analog DB-15 connectors are available, and Everex okays simultaneous

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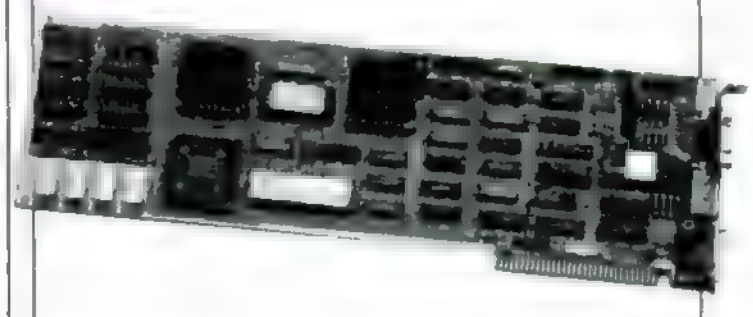

Everex EVGA
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Fremont, CA 94538
(800) 821-0806
(800) 821-0807 (in Calif.)
List Price: $399
Requires: PC, XT, AT, or compatible, or PS/2 Model 30
In Short: A full-length register-compatible VGA board with good backward compatibility for analog or digital monitors and a maximum resolution ability of 1,280 by 600 in four colors.

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VGA Boards: Summary of Features

(Products listed in ascending price order)

VIDEO STANDARDS SUPPORTED	Tecmar VGA Tecmar Inc. $395	Ultra-Grafix VGA Model 580 Card Taxan USA Corp. $395	Everex EVGA Everex Systems Inc. $399	Paradise VGA Plus Card Paradise Systems Inc. $399	Sigma VGA/H Sigma Designs Inc. $399	Tatung VGA Platinum Card Tatung Co. of America Inc. $429	Designer VGA Orchid Technology $445	Intelligent VGA Board Intelligent Data Systems Inc. $445	VEGA VGA Video Seven Inc. $499
MDA	●	●	●	●	●	●	●	●	●
HGC	●	●	●	●	●	●	●	●	●
CGA	●	●	●	●	●	●	●	●	●
EGA	●	●	●	●	●	●	●	●	●
VGA COMPATIBILITY									
BIOS	●	●	●	●	●	●	●	●	●
Register	●	●	●	●	●	●	●	●	●
CONNECTORS									
9-pin	●	○	●	○	●	●	●	●	●
15-pin	●	●	●	●	●	●	●	●	●
OUTPUT									
Digital	●	○	●	○	●	●	●	●	●
Analog	●	●	●	●	●	●	●	●	●
MAXIMUM RESOLUTION									
Graphics (pixels)	800 × 600	800 × 600	1,280 × 600	800 × 600	640 × 480	800 × 560	1,024 × 768	800 × 560	800 × 600
Text (columns × rows)	132 × 44	132 × 43	132 × 44	132 × 44	80 × 30	132 × 44	132 × 44	132 × 44	132 × 43
COLORS									
Max. no. of on-screen colors	256	256	256	256	256	256	256	256	256
Total no. of colors in palette	262,144	262,144	262,144	262,144	262,144	262,144	262,144	262,144	262,144

●—Yes —No

use of both. You can plug in two different types of monitors—one into each connector (with some limitations)—and the EVGA board will produce the optimum image for each. Everex notes, however, that on-screen images may be dimmer due to the double termination (loading) of the EVGA's outputs.

The only thing lacking from the EVGA hardware is a VGA-style Video Feature Connector. In its stead, Everex has installed a 20-pin header with the same pinout (but not the same form factor) as that of the Micro Channel architecture video bus extension.

An array of jumpers and an eight-bank DIP switch, accessible through a retaining bracket cutout, are used to set up the EVGA. One bank of jumpers changes the DB-9 connector from digital to analog outputs. Other jumpers alter the base address and interrupt used by the board to avoid conflicts with other system enhancements. The DIP switches select the boot-up mode and type of monitor being used with the board. Color or monochrome VGA-style monitors plugged into the DB-15 connector automatically override these settings and set the jack to the output mode the monitor requires.

The EVGA has a limited automatic mode-switching ability. It can sense which display mode the software requires and attempt to match its function in its circuitry. However, Everex notes that sometimes this process is not entirely effective—for instance, when switching from Hercules to EGA modes. Consequently, Everex recommends using a special utility supplied with the board, EVGAMODE, for altering the operating mode of the board when moving between programs that ostensibly require different video adapters. The EVGA will, however, emulate Hercules-style graphics on otherwise incompatible monitors.

ENHANCED EGA MODES Besides the VGA and underlying standard modes, the EVGA also has several "enhanced EGA" modes, including three 94-column text modes (with 25, 29, or 51 rows), three 100-column text modes (with 37, 43, or 75 rows), and ten 132-column text modes (with 25 or 44 rows and various character matrices). Extended graphics modes include three using 256 simultaneous colors (512 by 480, 640 by 350, and 640 by 400 pixels), two 16-color modes (752 by 410 or 800 by 600 pixels), and two super-high-resolution four-color modes (1,280 by 350 or 1,280 by 600 pixels).

Using these advanced modes requires a MultiSync-style monitor and may require special driver software. Everex supplies drivers for *AutoCAD* and *Lotus 1-2-3* (Re-

VGA Add-in Board Architecture

VGA-compatible display adapters are designed to let you update the graphics capabilities of your existing PC, XT, or AT, allowing your system to display up to 256 colors from a palette of 262,144. The architecture of these boards, like that of the Sigma VGA/H shown here, supports register-level compatibility with the VGA standard. Many of these 8-bit boards feature both DB-9 and DB-15 connectors and also support a proprietary video mode that lets them deliver resolution that goes beyond VGA's 640 by 480 in 16 colors. Some, like the Sigma VGA/H, sport the VGA Video Feature Connector. With the exception of the full-length Everex EVGA, all of the boards evaluated here are half-length.

The Sigma VGA/H

100-nanosecond DRAM chip

The 256K of socketed 100-nanosecond DRAM is used to display text and images and speed up screen refresh time.

VLSI video chip

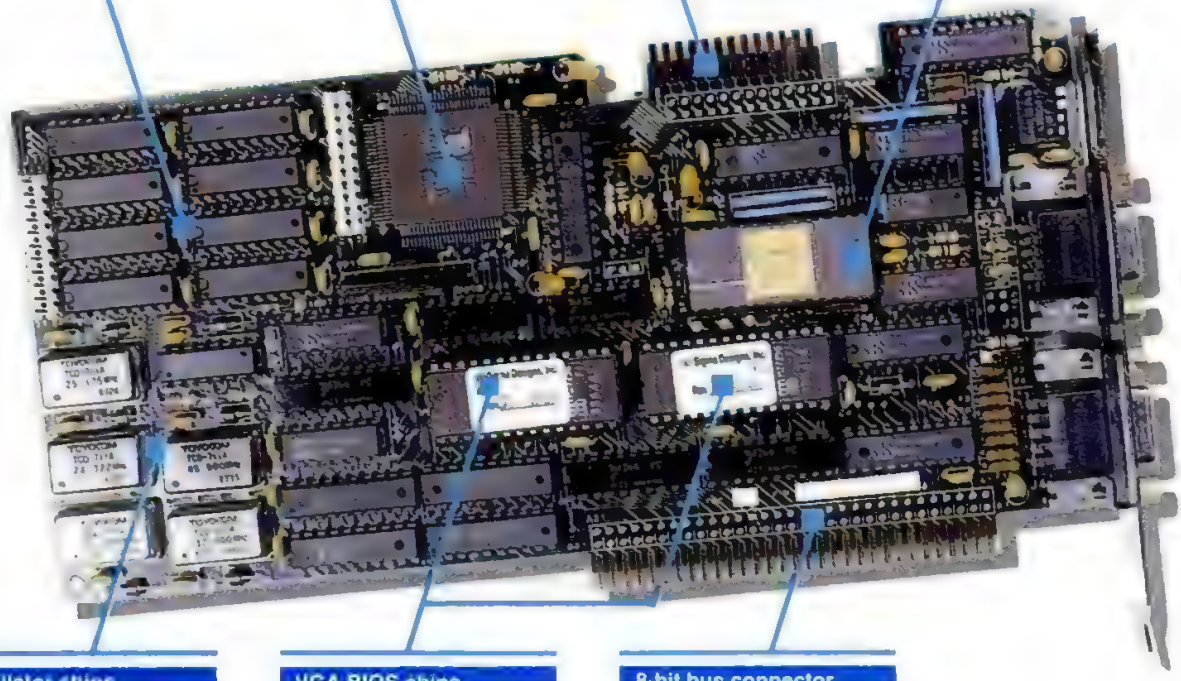
The VGA chip set, in this case from Tseng Labs, is a large VLSI chip that implements video circuitry control of the system's graphics controller.

VGA Video Feature Connector

The VGA Video Feature Connector, which is analogous to the feature connector found on EGA and EGA-compatible boards, is a port that allows for future enhancements to the display adapter board.

Inmos DAC

The Inmos Digital-to-Analog Converter (DAC) chip lets the board share digital and analog signals.



Oscillator chips

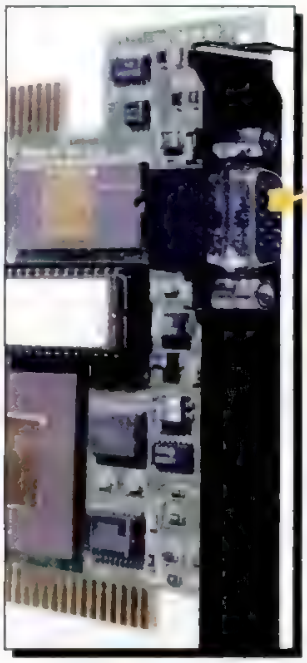
Five oscillator chips control the different clock frequencies that the board uses to handle each different video mode.

VGA BIOS chips

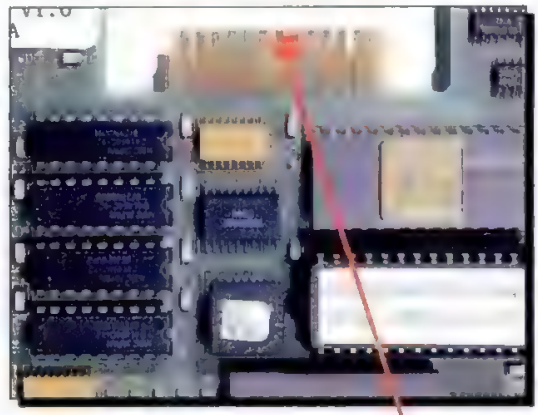
The VGA BIOS chips support the functions of the VGA registers.

8-bit bus connector

The 8-bit bus connector fits into both the 8-bit and 16-bit slots on the IBM PC, XT, and AT computers and compatibles.

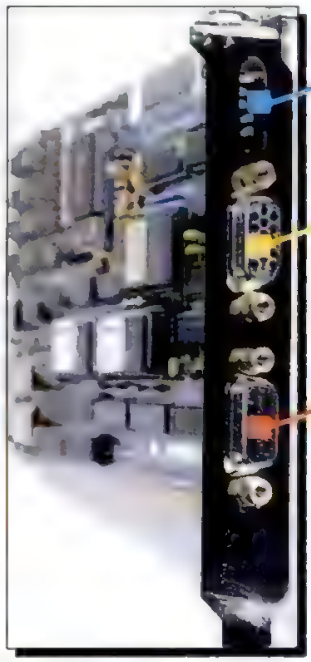


The Paradise VGA Plus Card, on which the Taxan Ultra-Grafix VGA Model 580 Card is modeled, offers only a single DB-15 connector at the rear of the board. However, Paradise does supply a 15-pin-to-9-pin connector, which allows the board to support Hercules, MDA, and CGA modes and to work with many styles of monitors.



Taxan's VGA Video Feature Connector

Taxan uses a finger-type connector for additional features similar to those offered on the Sigma board. These types of connectors do differ, though, as you can see with the Video Feature Connector available on the VEGA board.



Sigma's four-position DIP switch

The four-position DIP switch allows you to change the board's video mode.

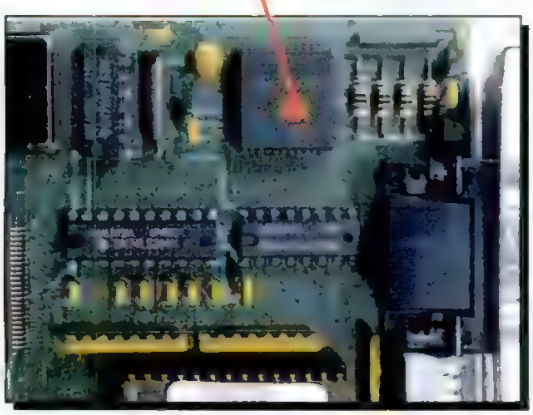
The DB-15 connector, which matches the jack on the PS/2, supplies analog signals to match VGA-style monitors.

DB-9 connector

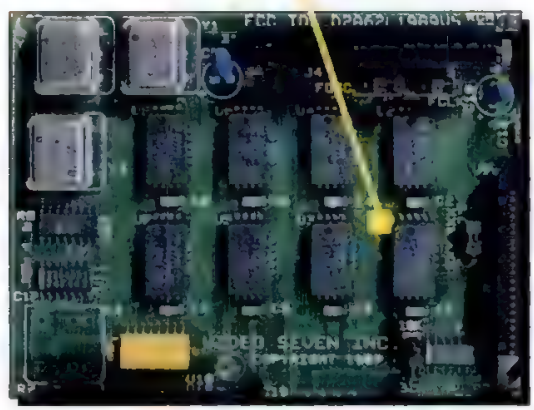
The DB-9 connector supplies digital signals to match previous video standards, including MDA, CGA, and EGA.

Tecmar's DAC from Brook Tree

Conspicuously absent from the Tecmar VGA is the standard Inmos DAC, which is used by IBM VGA and its clones. Instead, the Tecmar VGA uses a smaller DAC from Brook Tree.



The small footprint of the eight RAM chips (256K) on the Video Seven VEGA VGA shows an economy of design. Above the RAM chips is a female multipin feature connector.



lease 1A). In addition, a font-loading program, FONTLOAD, with 22 downloadable fonts is included.

The Everex EVGA passed all of the PC Labs VGA compatibility tests with the exception of direct writes in modes 7 and 15.

The strengths of the Everex EVGA are its very high compatibility and many enhanced EGA modes. Although it would benefit from a greater number of drivers and, perhaps, simplified setup, it nevertheless ranks as a good VGA alternative.

INTELLIGENT DATA SYSTEMS INC.

Intelligent VGA Board

Intelligent Data Systems calls its product the Intelligent VGA Board not just to echo the company name, but also to highlight one of the board's more-advanced features: it automatically adapts software images designed for one display to match whatever you have. Among those abilities, the $445 Intelligent VGA can put CGA graphics on a TTL monochrome display and EGA graphics on CGA displays. Beyond the standard 17 VGA modes, the Intelligent VGA can also generate 16-color graphics with resolutions up to a maximum of 800 by 560 pixels.

Seven inches long, the Intelligent VGA combines Chips and Technologies' VGA chip, an ATI Technologies VLSI circuit for its more-arcane any-graphics-on-any-display abilities, and an Inmos DAC. The board also includes 256K of 120-nanosecond RAM soldered to the board. Expansion is possible through the Intelligent VGA's EGA feature connector.

Physically, the Intelligent VGA bears more than a superficial resemblance to Tatung's Platinum Card, and it also mimics Tatung's compatibility with various standards. Although the Intelligent VGA is BIOS compatible with the IBM VGA standard, it is not 100-percent register-level-compatible. The Intelligent VGA also claims hardware compatibility with the EGA standard as well as BIOS compatibility with the MDA, CGA, and Hercules Graphics Cards. With a special adapter board, it will also drive the internal displays of Compaq portable computers.

The Intelligent VGA mates with both analog and digital displays through the female 9-pin and 15-pin D-shell connectors on its retaining bracket. In addition, an output for an RF modulator is also available as a header on the board itself.

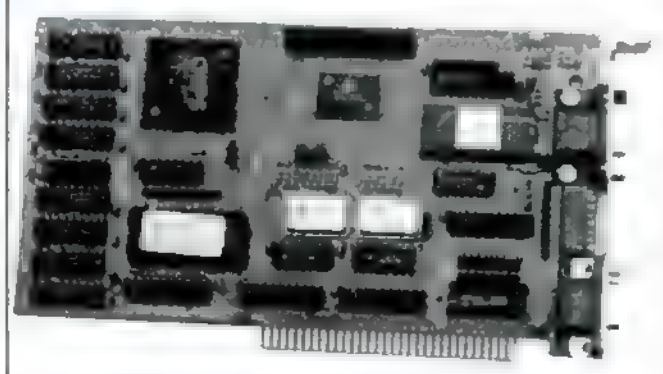
AUTOMATIC CONFIGURATION While the Intelligent VGA automatically configures itself for VGA-style displays, an eight-bank DIP switch that can be adjusted through a cutout in the bracket must be set to match MultiSync-style and digital monitors. Of the six sets of jumpers that line the edge of the Intelligent VGA card opposite its retaining bracket, only one, which sets the base address of the card to one of two values, is documented.

Besides supporting all current IBM video standards, the Intelligent VGA offers eight modes of its own. Text arrayed 132 columns by 25 rows is available on all but analog VGA monitors in 2 or 16 colors. Text arrayed 132 columns by 44 rows is available for all monitor types except VGA, CGA, and Portable Personal Computer internal displays, also in 2 or 16 colors. In addition, the Intelligent VGA features two 800- by 528-pixel modes (16-color graphics and 80-column by 66-row text in 16 colors), text 80 by 33 columns in 16 colors, and 800 by 560 graphics in 16 colors, all of which will require a MultiSync-style display.

To complement those modes, Intelligent Data Systems includes two disks of software. On them you'll find a control program for manually shifting video modes that also features a built-in screen saver to blank your monitor after a predetermined period of system inactivity. Drivers are supplied for the following applications: *AutoCAD*, *MicrosoftWindows*, *GEM*, *Ventura Publisher*, and *Lotus 1-2-3* (in 132-column text mode).

SLOW BIOS As might be expected, the Intelligent VGA performs nearly identically to the Tatung Platinum Card—both registered some of the slower speeds in the PC Labs performance and benchmark tests. The Intelligent VGA passed most of the PC Labs VGA compatibility tests. It failed the direct writes test in mode 13, and its video and CPU clocks were out of synch. Not far off the mark in terms of VGA compatibility, the Intelligent VGA can be used effectively in any system with any monitor, except in hardware-critical applications.

FACT FILE



Intelligent VGA Board
Intelligent Data Systems Inc.
6319 E. Alondra Blvd.
Paramount, CA 90723
(800) 325-2455
(213) 633-5504
List Price: $445
Requires: PC, XT, AT, or compatible, or PS/2 Model 30.
In Short: Both register compatible with the VGA standard and backward compatible with previous standards, this 7-inch board can generate 16-color graphics with resolution up to 800 by 560 pixels. One of its strengths is automatically adapting software images designed for one display to any display you have.

CIRCLE 698 ON READER SERVICE CARD

ORCHID TECHNOLOGY

Designer VGA

Anything that you buy today, you take with the full knowledge that you have one foot in obsolescence and the other on a greased banana peel. Orchid Technology can help you avoid that backward-slipping feeling with its Designer VGA. Offering more than just register-level VGA compatibility, the $445 product is fully backward compatible with all monochrome and color video standards. Moreover, it sneaks beyond the VGA specification with up to 256 colors at 640 by 480 resolution and ultimate capabilities of up to 1,024 by 768 pixels in 16 colors on interlaced displays.

What the Designer VGA is not is strictly VGA-hardware compatible. The 6-inch card lacks a VGA-style Video Feature Connector—or any expansion connector

Get your work done before 1991.

The future of personal computing is clear. More powerful PCs. Easier to use PCs. With graphics and character-based programs working side by side. Talking to each other. Multitasking. Windowing. Menuing. Mousing. Getting your work done easier and faster.

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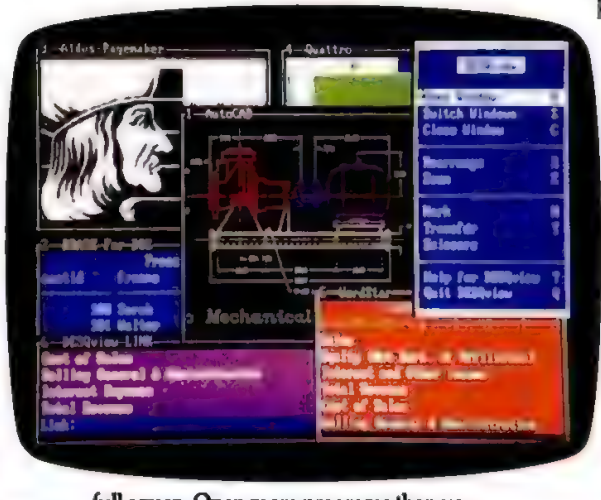
DESQview™ is the operating environment that gives DOS the capabilities of OS/2.™ And it lets you, with your trusty 8088, 8086, 80286, or 80386 PC, leap to the productivity of the next generation. For not much money. And without throwing out your favorite software.

Add DESQview to your PC and it quickly finds your programs and lists them on menus. So you can just point to the program, using keyboard or mouse, to start it up. DESQview knows where that program lives. And what command loads it.

For those who have trouble remembering DOS commands, it adds menus to DOS. It even lets you sort your files and mark specific files to be copied, backed-up, or deleted—all without having to leave the program you're in.

Best of all, DESQview accomplishes all this with a substantial speed advantage over any alternative environment.



For programmers, DESQview's API, with its strengths in inter-task communications and multi-tasking, brings a quick and easy way to adapt to the future. With the API's mailboxes and shared programs, programmers are able to design programs running on DOS with capabilities like those of OS/2.

Multitask beyond 640K.

When you want to use several programs together, you don't have to leave your current program. Just open the next program. View your programs in windows or full screen. Open more programs than you have memory for. And multitask them. In 640K. Or if you own a special EMS 4.0 or EEMS memory board, or a 386 PC, DESQview lets you break through the DOS 640K barrier for multitasking. If you have other non-EMS memory expansion products like AST's Advantage or the IBM® Memory Expansion Option, we have a solution for you, too. The ALL CHARGECARD™ 'unifies' all your memory to provide up to 16 megabytes of continuous workspace. DESQview lets you use this memory to enhance your productivity. You can start 1-2-3 calculating and tell Paradox to print mailing labels while you're writing a report in Word Perfect, or laying out a newsletter in Ventura Publisher, or designing a building in AutoCAD.

DESQview even lets you transfer text, numbers, and fields of information between programs.

Fulfill the 386 promise.

For 80836 PC users, DESQview becomes a 386 control program when used in conjunction with Quarterdeck's Expanded Memory Manager (QEMM)-386—giving faster multitasking as well as virtual windowing support.

And when you use DESQview on an IBM PS/2™ Model 50 or 60 with QEMM-50/60 and the IBM Memory Expansion Option, DESQview gives you multitasking beyond 640K.

Experts are voting for DESQview. And over a million users, too.

If all of this sounds like promises you've been hearing for future systems, then you can understand why over a million users have chosen DESQview. And why *PC Magazine* gave DESQview its Editor's Choice Award for "The Best Alternative to OS/2," why readers of *InfoWorld* twice voted DESQview "Product of the Year" why, by popular vote at Comdex Fall for two years in a row, DESQview was voted "Best PC Environment" in *PC Tech Journal's* Systems Builder Contest.

PC MAGAZINE EDITORS' CHOICE NOV. 24, 1987

INFO WORLD 1986 AND 1987 PRODUCT OF THE YEAR

DESQview lets you have it all now.

DESQVIEW SYSTEM REQUIREMENTS:
IBM Personal Computer and 100% compatibles (with 8086, 8088, 80286, or 80386 processors) with monochrome or color display; IBM Personal System/2• Memory: 640K recommended, for DESQview itself: 0-145K • Expanded Memory (Optional): expanded memory boards compatible with the Intel AboveBoard; enhanced expanded memory boards compatible with the AST RAMpage; EMS 4.0 expanded memory boards• Disk: two diskette drives or one diskette drive and a hard disk•Graphics Card (Optional): Hercules, IBM Color/Graphics (CGA); IBM Enhanced Graphics (EGA), IBM Personal System/2 Advanced Graphics (VGA)• Mouse (Optional): Mouse Systems, Microsoft and compatibles• Modem for Auto-Dialer (Optional): Hayes or compatible• Operating System: PC-DOS 2.0-3.3; MS-DOS 2.0-3.2• Software: Most PC-DOS and MS-DOS application programs; programs specific to Microsoft Windows 1.03-2.03, GEM 1.1-3.0, IBM TopView 1.1• Media: DESQview 2.0 is available on either 5-1/4" or 3-1/2" floppy diskette.

YES! I need increased productivity now!

Qty	Product	Format	Price Each	Totals
	DESQview 2.0	❑5-1/4 ❑3-1/2	$129.95	
	QEMM-386	❑5-1/4 ❑3-1/2	$59.95	
	QEMM-50/60	❑5-1/4 ❑3-1/2	$59.95	
	ALL CHARGECARD (Special for DESQview owners)		$200.00*	
		Shipping & Handling	$5 in USA/ $10 outside USA	
		Calif Residents add 6.5%		
			Grand Total	

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(213) 392-9851

*This ALL CHARGECARD is designed for the IBM PC AT and PS/2 50 and 60. If you have another type of 80286-based PC, there's a version for you, too. Please call 1-800 387-2744 for special ordering information. Offer expires August 31, 1988.
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CIRCLE 474 ON READER SERVICE CARD

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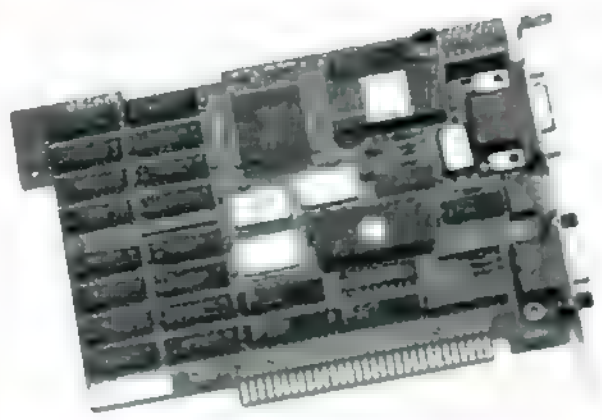

Designer VGA
Orchid Technology
45365 Northport Loop W.
Fremont, CA 94538
(800) 638-3322
(415) 683-0300
List Price: $445
Requires: PC, XT, AT, or compatible, or PS/2 Model 30
In Short: A short board that combines VGA register compatibility and backward compatibility with previous video standards with 512K RAM, allowing resolutions up to 1,024 by 768 in 16 colors. Works with any monitor type.

CIRCLE 697 ON READER SERVICE CARD

at all. However, its 512K of on-board 100-nanosecond memory should take care of most future possibilities. Most of its capabilities derive from the Tseng Labs VLSI chip it's built around and its Inmos DAC.

ROOM TO GROW The Designer VGA excels in monitor compatibility. It gives you a solid growth path from IBM's original TTL Monochrome Display all the way up to the latest VGA and MultiSync-style monitors. Only archaeologists may be disappointed that it does not support standard CGA monitors.

The Designer VGA does require a minor setup to match it to your monitor before use. A jumper selects between monochrome and color modes, and a bank of four DIP switches selects the monitor standard. The switch (but not the jumper) can be adjusted through a cutout in the card-retaining bracket.

The Designer VGA adapts images for one standard, for instance Hercules, and readily displays them on another standard such as VGA. It will also display noncompatible VGA modes, for instance, putting monochrome VGA modes on color VGA displays.

Both DB-9 and DB-15 connectors are available for digital- and analog-interfaced monitors, respectively. With MultiSync-style monitors, resolutions beyond VGA include 800 by 600 in 16 or 256 colors, and the 1,024 by 768 interlaced display (which is not compatible with NEC MultiSync monitors). In addition, six 132-column modes are supported—three monochrome and three color—with character box matrices of 9 by 8, 9 by 14, and 9 by 13 in each.

DRIVERS AND UTILITIES Orchid supplies high-resolution drivers for *Lotus 1-2-3*, *Microsoft Windows* (including Version 2.0), and *AutoCAD* , as well as several utilities, some specialized (*AutoCAD* zooming) and some not (mode changing).

In testing, the Designer VGA proved almost unremarkable—and that's good. Its scores on the PC Labs performance and benchmark tests fall into the middle-to-slow category. The Designer VGA passed four of the eight PC Labs VGA compatibility tests.

Choose the Designer VGA if you want to maximize your flexibility in connecting different display types to your PC, XT, or AT, and in taking advantage of all possible video modes including very high resolution.

PARADISE SYSTEMS INC.

Paradise VGA Plus Card

The "Plus" in the name of Paradise Systems' VGA Plus Card tells only part of the story. While the $399 adapter rates a true plus in its ability to go beyond the VGA standard to up to 800 by 600 resolution in 16 colors, it also dips below the standard, too. In so doing, it adds full backward software compatibility with all previous major video standards—MDA, Hercules Graphics, CGA, MCGA, and EGA—to PCs (except for the early 64K system board model), XTs, ATs, PS/2 Models 25 and 30, and compatibles.

All of those potentials are contained on a completely hardware-compatible 8-bit expansion card that's only 5¼ inches long. Most of the circuitry of the card is contained in one Paradise VLSI chip, supplemented by an Inmos DAC. The 256K of video memory on the card is rated at 120 nanoseconds.

ANALOG CONNECTOR At the top of the card is the requisite VGA Video Feature Connector. The card's retaining bracket is decorated solely with an analog DB-15 connector, which precludes the possibility of plugging in an incompatible display. The VGA Plus works with both color and monochrome monitors that follow the VGA standard, as well as MultiSync-style displays equipped with analog inputs.

Normally, no hardware setup is required when installing the VGA Plus. Per the VGA standard, it configures itself to accommodate monochrome or color displays and allows using only the display mode supported by that monitor type. However, Paradise also includes a utility program called VGAPLUS, which allows

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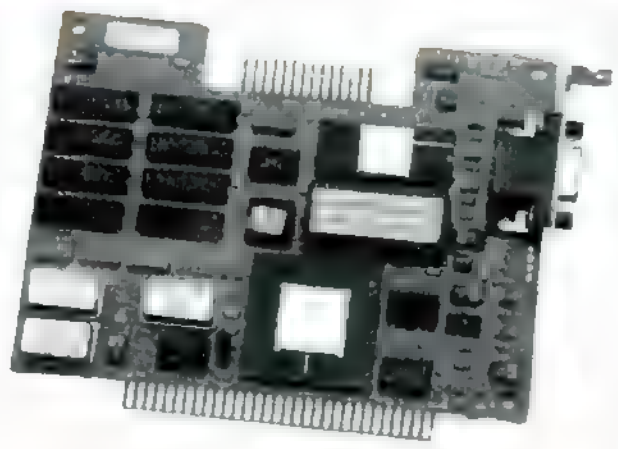
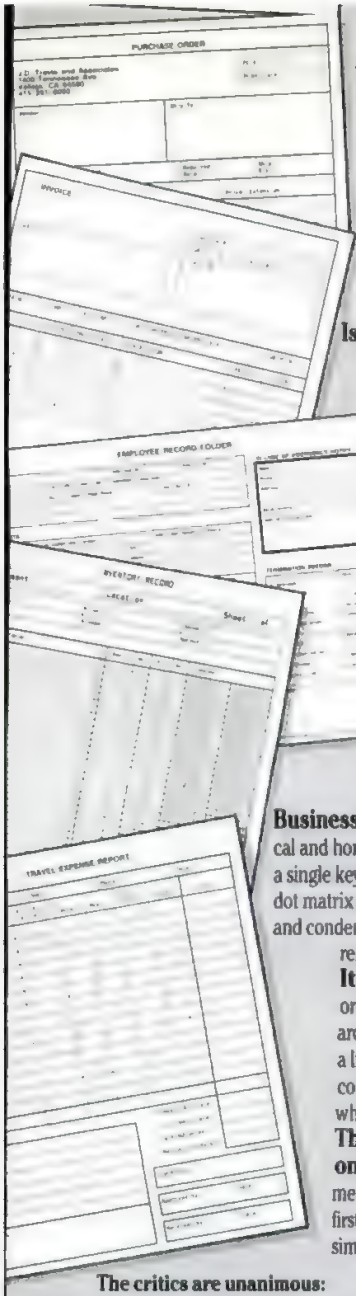


Paradise VGA Plus Card
Paradise Systems Inc.
99 S. Hill Dr.
Brisbane, CA 94005
(415) 468-7300
List Price: $399
Requires: PC, XT, AT, or compatible, or PS/2 Model 25 or 30
In Short: This 5¼-inch board offers a top resolution of 800 by 600 pixels in 16 colors; 256K of video memory; register compatibility with the VGA standard; backward compatibility with MDA, Hercules Graphics, CGA, MCGA, and EGA; and drivers for many popular software packages.

CIRCLE 696 ON READER SERVICE CARD

Business Forms That Mean Business



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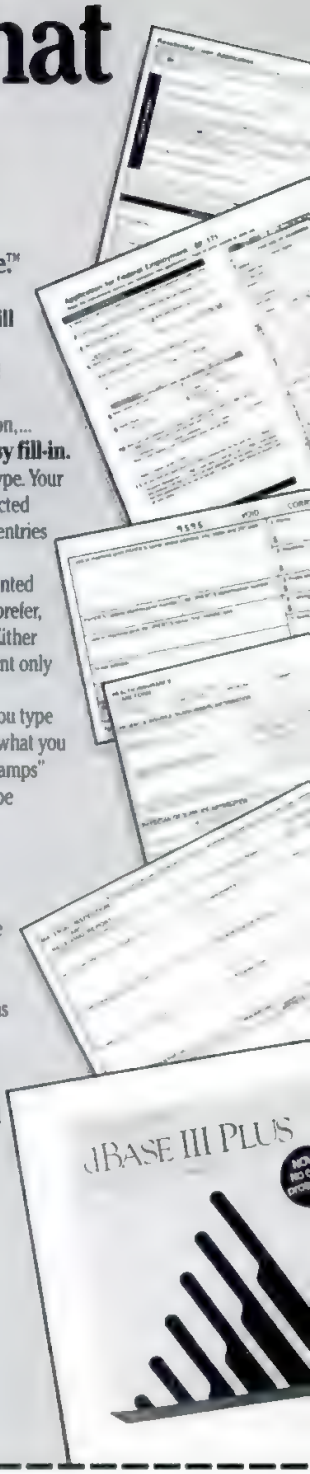

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Hardware requirements: Over 125 printers supported. Requires IBM PC, PS/2, or compatible with DOS 2.0 or higher. FormWorx—320 kB. FormWorx with Fill & File—512 KB. Works with or without a graphics board. Color is displayed on color systems. Available on 3.5" disks when specified. Not copy protected.

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PCM7/88

VGA Boards

PC Labs tested nine VGA boards that are IBM VGA BIOS-level as well as register-level compatible. Each was compared with the IBM PS/2 Display Adapter running in an 8-bit slot. The results for the Compaq Video Graphics Controller Board running in an 8-bit slot in an IBM PC AT were included for comparison's sake as were results for the same tests in a 16-bit slot and for the built-in VGA on an IBM PS/2 Model 60. The Windows Performance Tests and Video Benchmark Tests for VGA cards were run in a *Microsoft Windows*, Version 2.03, environment under DOS 3.2 on an 8-MHz IBM PC AT, an IBM PS/2 Model 60, and a Compaq Deskpro 386/20.

Overall, the IBM PS/2 Display Adapter board performed poorly in all the Windows Performance Tests. In two of the three Video Benchmark Tests, the IBM board came out somewhat slower than average; it was the slowest of the bunch in the Direct to Screen test. The Model 60 came out strong in the Video BIOS Routine Without Scrolling, owing in part to its 10-MHz speed. And while the Compaq V.G.C. Board's Direct to Screen test results show it's over twice as fast as any other VGA add-in board on the market, you need the appropriate device driver to take full advantage of this speed.

The Paradise VGA Plus Card fared well on most of the tests, with less-impressive results on only a few tests. Taxan's Ultra-Grafix VGA Model 580 Card also performed well throughout all tests. This, however, should be viewed as no coincidence: Taxan is using the identical board as Paradise Systems'.

Windows Performance Tests

Seven *Windows* call routines—LineTwo, Rectangle, Scrollwindow, FillRect, Ellipses, Bitblt, and Stretchblt—are used for the tests.

The **60- by 20-Line Windows Test** measures the time it takes to perform the LineTwo function in a window that is 60 characters wide and 20 lines down. For the **Full-Screen Windows Test**, the **Lines** test measures the time it takes to draw 100 random lines of various colors. The **Rectangles** test measures the time it takes to draw 100 rectangles of random size and color. The **Ellipses** test measures the time it takes to draw 100 ellipses of random size and color. The **Bitblt** test measures the time it takes to draw 100 rectangles of the same size. The **Stretchblt** test measures the time it takes to draw 100 rectangles of varying size but the same color. The **Scroll** test creates a rectangle that is 1/10 the height and 1/10 the width of the window in the upper-left-hand corner of the screen and measures the time it takes to scroll to the right pixel by pixel, down pixel by pixel, and diagonally to the upper left pixel by pixel. The **Fill** test measures the time it takes to fill the window 512 times with a color. The results for the Windows Performance Tests are expressed in milliseconds per single operation because of the varying size of different screens.

Video Benchmark Tests

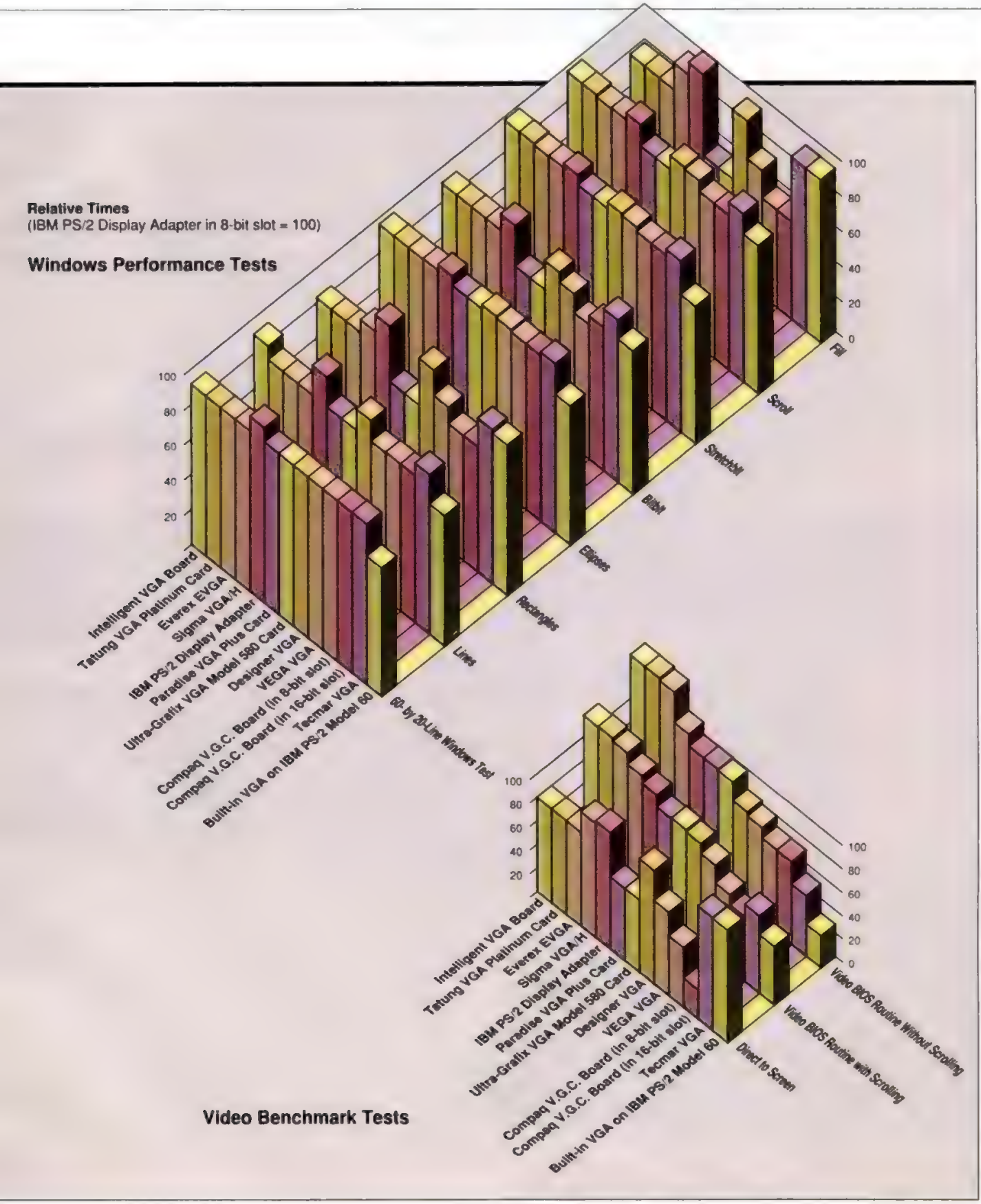
The **Direct to Screen** benchmark test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is peformed in video mode 3. The entire screen is updated using the assembly language REP STOSW instruction with register CX equal to 2000. This is done 1,000 times, and the result shown is the total of the 1,000 trials.

The **Video BIOS Routine with Scrolling** benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared, and 240 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

The **Video BIOS Routine Without Scrolling** benchmark test measures the speed of the BIOS Teletype routine without scrolling. The test is performed in video mode 3. The screen is cleared, and 24 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. This is done ten times, and the result shown is the total of the ten trials.

Performance Times
(Times given in seconds except where noted)

	Windows Performance Tests (milliseconds)								Video Benchmark Tests		
		Full-Screen Windows Test									
	60- by 20-Line Windows Test	Lines	Rectangles	Ellipses	Bitblt	Stretchblt	Scroll	Fill	Direct to Screen	Video BIOS Routine with Scrolling	Video BIOS Routine Without Scrolling
Intelligent VGA Board	5.5	6.0	19.2	201.0	11.0	820.0	16.1	54.5	5.6	10.1	7.6
Tatung VGA Platinum Card	5.5	5.5	19.2	201.0	11.0	821.5	16.1	54.6	5.6	10.2	7.6
Everex EVGA	5.5	5.5	19.2	201.0	11.0	813.8	15.9	54.5	5.6	9.9	7.5
Sigma VGA/H	5.5	5.5	20.9	202.1	11.0	817.8	16.0	65.1	6.8	9.1	6.1
IBM PS/2 Display Adapter	6.0	6.6	23.1	208.7	12.1	836.0	16.6	69.9	6.9	8.6	5.6
Paradise VGA Plus Card	5.5	5.5	15.9	197.5	9.3	789.2	14.6	37.4	4.3	7.7	5.6
Ultra-Grafix VGA Model 580 Card	5.5	5.5	15.9	197.6	9.3	789.4	14.6	37.4	4.3	7.7	5.5
Designer VGA	5.5	6.3	22.0	202.1	11.3	819.3	15.9	65.2	6.8	7.6	4.6
VEGA VGA	5.5	5.5	18.7	200.1	10.6	810.8	15.7	50.2	5.0	6.9	4.7
Compaq V.G.C. Board (in 8-bit slot)	5.5	5.5	16.5	197.7	9.3	789.8	14.7	39.2	3.6	5.6	4.0
Compaq V.G.C. Board (in 16-bit slot)	5.5	5.5	16.5	197.7	9.9	789.8	14.7	39.2	1.8	4.8	4.0
Tecmar VGA	5.5	6.0	20.3	201.9	11.2	817.3	15.9	65.0	6.8	5.8	2.9
Built-in VGA on IBM PS/2 Model 60	4.4	4.9	19.8	165.9	9.9	655.3	14.0	65.0	6.7	4.3	1.5


Relative Times
(IBM PS/2 Display Adapter in 8-bit slot = 100)
Windows Performance Tests
100
80
60
40
20
Intelligent VGA Board
Tatung VGA Platinum Card
Everex EVGA
Sigma VGA/H
IBM PS/2 Display Adapter
Paradise VGA Plus Card
Ultra-Grafix VGA Model 580 Card
Designer VGA
VEGA VGA
Compaq V.G.C. Board (in 8-bit slot)
Compaq V.G.C. Board (in 16-bit slot)
Tecmar VGA
Built-in VGA on IBM PS/2 Model 60
Lines
Rectangles
Ellipses
BitBlt
StretchBlt
Scroll
Fill
60- by 20-Line Windows Test
Video Benchmark Tests
Direct to Screen
Video BIOS Routine with Scrolling
Video BIOS Routine Without Scrolling

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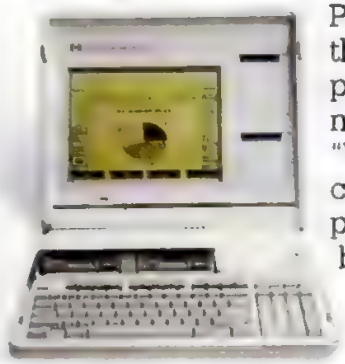

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CIRCLE 357 ON READER SERVICE CARD

Benchmark Tests: VGA Boards

	VGA Software Compatibility					VGA Hardware Compatibility							
	Color Bar	Character Set	Character Attributes	Line Pattern	DAC Palette	Direct Writes to Frame Buffer (20 modes)	Direct Palette Access	VGA Write Modes	Status Register	Vertical Blank Interrupt	Pan and Scroll	Programmable Character Generator	Split Screen
Intelligent VGA Board	Pass	Pass	Pass	Pass	Pass	Fail (mode 13)	Pass	Pass	Fail	Fail	Pass	Pass	Pass
Tatung VGA Platinum Card	Pass	Pass	Pass	Pass	Pass	Fail (mode 13)	Pass	Pass	Fail	Fail	Pass	Pass	Pass
Everex EVGA	Pass	Pass	Pass	Pass	Pass	Fail (modes 7, 15)	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Sigma VGA/H	Pass	Pass	Pass	Pass	Pass	Fail (modes 7, 13, 15, 16)	Pass	Pass	Pass	Fail	Fail *	Pass	Pass
IBM PS/2 Display Adapter	Pass	Pass	Pass	Pass	Pass	Fail (modes 7, 15)	Pass	Pass	Pass	Fail	Pass	Pass	Pass
Paradise VGA Plus Card	Pass	Pass	Pass	Pass	Pass	Fail (modes 7, 15)	Pass	Pass	Pass	Fail	Pass	Pass	Pass
Ultra-Grafix VGA Model 580 Card	Pass	Pass	Pass	Pass	Pass	Fail (modes 7, 15)	Pass	Pass	Pass	Fail	Pass	Pass	Pass
Designer VGA	Pass	Pass	Pass	Pass	Pass	Fail (modes 7, 13, 15, 16)	Pass	Pass	Fail	Fail	Fail *	Pass	Pass
VEGA VGA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail *	Pass	Fail
Compaq V.G.C. Board (in 8-bit slot)	Pass	Pass	Pass	Pass	Pass	Fail (modes 7, 15)	Pass	Pass	Pass	Fail	Pass	Pass	Pass
Compaq V.G.C. Board (in 16-bit slot)	Pass	Pass	Pass	Pass	Pass	Fail (modes 7, 15)	Pass	Pass	Pass	Fail	Pass	Pass	Pass
Tecmar VGA	Pass	Pass	Pass	Pass	Pass	Fail (modes 13, 15)	Pass	Pass	Pass	Pass	Fail *	Pass	Pass
Built-in VGA on IBM PS/2 Model 60	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

* Diagonal scrolling is jumpy.

To define "true" register compatibility, it is necessary to first define compatibility itself. IBM has introduced two types of VGA, one with the on-board PS/2 VGA system and the other with its plug-in VGA card. Neither of these is totally compatible with the other on all levels.

In designing the VGA circuitry of their boards, many manufacturers have opted to use the plug-in IBM VGA card as their model. The PC Labs benchmark tests are based on the VGA environment of the Micro Channel PS/2 and were designed to test compatibility with this standard.

The contradictory result is that while the boards tested may indeed be register compatible with the IBM PS/2 Dispay Adapter, none is absolutely compatible with the built-in VGA system of the IBM PS/2 Model 60. As a practical matter, these VGA boards will work with applications that follow the less stringent plug-in VGA standard but may have problems with software that attempts to access the full range of abilities found in the built-in VGA system. For most applications, that level of compatibility should be good enough.

The nine boards tested passed all of the PC Labs VGA Software Compatibility tests, which means that their BIOS interface is consistent with the IBM definition. Programs adhering strictly to BIOS should run on any of these boards.

In the PC Labs VGA Hardware Compatibility tests, the built-in VGA on the IBM PS/2 Model 60 and Video Seven's VEGA VGA were the only boards to successfully display all 20 video modes. However, the VEGA VGA, which is perhaps best regarded as an enhanced EGA card that should work with most VGA software, failed four out of the seven PC Labs VGA Hardware Compatibility tests.

Typically, boards that have failed the Pan and Scroll test can pan and scroll, albeit in a step pattern or with a certain degree of jumpiness. And boards that failed the Status Register test could cause graphics-oriented video games to operate improperly.

Only the built-in VGA on the IBM PS/2 Model 60 passed all of the PC Labs VGA Hardware Compatibility tests. Coming in right behind the PS/2 Model 60 is the Everex EVGA board, which only failed modes 7 and 15 (which are monochrome modes) in the Direct Writes to Frame Buffer video modes test. The other modes that gave the boards some trouble were mode 13, the high-color mode (320 by 200 pixels in 16 colors) for EGA, and mode 16, the high-resolution mode (640 by 350 pixels in four colors) for EGA. Boards that failed mode 16 are not fully EGA compatible at the hardware level.

The IBM PS/2 Display Adapter, the Compaq V.G.C. Board, Taxan's Ultra-Grafix VGA Model 580 Card, the Paradise VGA Plus Card, and the Tecmar VGA ranked well overall, failing only two video mode tests and one other VGA Hardware Compatibility test. They are followed by the Tatung VGA Platinum Card and the Intelligent VGA Board, which failed one video mode test and two other VGA Hardware Compatibility tests.

The **VGA Software Compatibility** tests use the VGA BIOS to perform various operations, including displays of color bars, displays of characters, characters with various attributes, and an octagon made up of lines of various colors. These tests are similar to those used on the CGA and EGA. An additional color bar test in the 256-color VGA mode displays all colors at once. Programs that use only VGA BIOS calls should work with boards that pass the VGA Software Compatibility tests.

The **VGA Hardware Compatibility** tests bypass the VGA BIOS to go directly to the VGA hardware. They include writing directly to the VGA RAM, changing the colors of the display palette by using the digital-to-analog-converter (DAC) chip directly, selecting each VGA mode using hardware registers, and checking the on-board clock versus the PC's clock. The clock is used by some software to detect the vertical blank interval (VBI), which allows a program to update the screen without flickering.

The pan and scroll hardware support was tested along with split screen and programmable character generator support. These features are often used by high-end graphics packages and sophisticated terminal emulator programs. Adapters that are only VGA BIOS compatible will probably fail one or more of the VGA Hardware Compatibility tests. Many programs, including *Microsoft Windows/386*, require hardware compatibility for VGA adapters.

the board to mimic any supported video standard. For instance, after you configure the VGA Plus with the program, your Hercules graphics programs will execute all their routines on your VGA display.

The VGA Plus has only one hardware jumper, which selects whether the board will have its 800 by 600 mode accessible or will keep its Video Feature Connector completely IBM compatible. The factory setting, high resolution enabled, should not be a problem because no accessories yet make use of the connector.

For true VGA hardware compatibility, the Paradise VGA Plus is a good choice. Its higher-resolution mode is a windfall for owners of MultiSync-style monitors.

MULTITUDE OF DRIVERS The high-resolution mode of the VGA Plus requires the use of a MultiSync-style monitor. In addition, your software must be compatible to take advantage of it. Paradise supplies drivers to handle *Microsoft Windows* (Version 2.0 only), *GEM*, *AutoCAD*, *CADvance*, *Ventura Publisher*, and *Framework II*. The VGA Plus also has two 132-column text modes, 25- and 43-row. Drivers are supplied to support *Framework II*, *WordStar*, Version 3.3; *WordStar Professional*, Release 4.0; and *WordPerfect*, all in 132-column mode.

The Paradise VGA Plus rates among the most compatible VGA boards available. It passed five out of the eight PC Labs VGA compatibility tests, displaying excellent scrolling capabilities in the split-screen test. Like the Taxan Ultra-Grafix VGA, its performance was among the best in the PC Labs *Windows* performance tests and average in the PC Labs video benchmark tests.

For true VGA hardware compatibility, the Paradise VGA Plus is a good choice. Its added higher-resolution mode is a wonderful windfall for owners of MultiSync-style monitors.

SIGMA DESIGNS INC.

Sigma VGA/H

The "H" in the name of the Sigma VGA/H must stand for "hardware compatible" in that Sigma Designs claims it to be hardware compatible with all IBM video standards as well as Hercules graphics. Moreover, it's the only VGA board compatible with digital input monitors that also includes a VGA-style Video Feature Connector. On the other side of the connection, the $399 VGA/H will mate with any PC or compatible, as well as PS/2 Models 25 and 30. It even stretches the VGA level of resolution up to 800 by 600 pixels in 16 colors when you have a MultiSync-style display.

The features of the VGA/H are brought to life with a Tseng Labs VGA chip, an Inmos DAC, and 256K of socketed 100-nanosecond DRAM chips. All fit on an 8¼-inch board that uses an 8-bit interface.

SUPPORTS MANY STANDARDS Sigma Designs claims hardware compatibility with MDA, Hercules Graphics, CGA, MCGA, EGA, and VGA display standards. In addition, it plugs into both digital and analog monitors using the female 9-pin and 15-pin D-shell connnectors on its retaining bracket.

Not all display standards are compatible with all monitor types, however. MultiSync-style displays will handle all modes of the VGA/H; IBM VGA displays will show everything (including Hercules Graphics) except the highest resolution modes. Other display types are limited basically to the standards for which they were designed (with a few exceptions).

The VGA/H supports both 800- by 560- and 800- by 600-pixel 16-color graphics modes, as well as a wealth of 132-column text modes. Four of these produce 25 rows of characters, including modes for all monitor types except IBM VGA (including MDA, CGA, EGA, and MultiSync-style). Three modes allow 44 rows of text on MDA, EGA, and MultiSync-style displays. The VGA/H will also put monochrome VGA images on color VGA displays (and vice versa) without a complaint.

Setting up the VGA may require moving a single jumper or toggling some of the four DIP switches that can be seen through the retaining bracket of the card. No other adjustments are required.

ADVANCED MODES Sigma Designs does not include special drivers with the VGA/H, but instead relies on software to take advantage of its advanced modes. A utility called DISPLAY is included for switching display modes (with VGA- and MultiSync-style displays, most mode switching is automatic), blanking your monitor screen after a preset period, and booting games on the VGA/H using otherwise incompatible displays. Proprietary diagnostics are also included.

In testing, the VGA/H demonstrated hardware compatibility that places it in the top tier of the boards reviewed here. The board passed five out of eight of the PC Labs VGA compatibility tests and excelled

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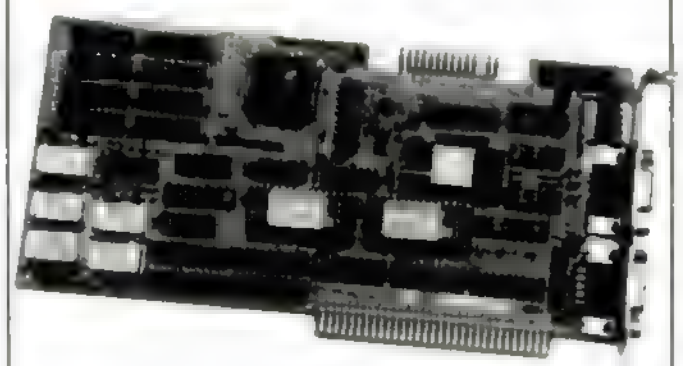


Sigma VGA/H
Sigma Designs Inc.
46501 Landing Pkwy.
Fremont, CA 94538
(415) 770-0100
List Price: $399
Requires: PC, XT, AT, or compatible, or PS/2 Model 30.
In Short: The only VGA add-in board compatible with digital input monitors that also includes a VGA-style Video Feature Connector, the Sigma VGA/H is compatible with all IBM video standards as well as Hercules Graphics and offers resolutions up to 800 by 600 pixels in 16 colors for MultiSync-style displays.

CIRCLE 695 ON READER SERVICE CARD

RESOLUTION À LA MODE

To help you compare VGA, EGA, and CGA output, we show the same image created in each of the three modes. The image, designed by PC Labs, was created using *Dr. Halo III* from Media Cybernetics and contains both type and a curved graphic to facilitate comparison.

In photo A, you can see the image in VGA's highest resolution mode, 640 by 480 pixels in 16 colors. The image in photo B was created in VGA's 256-color mode at a resolution of 320 by 200. Photo C shows the image in EGA's 16-color 640 by 350 resolution. Photo D shows the four-color 320 by 200 resolution of CGA. The curvature of the pie chart and of the block characters is smoothest in the highest resolution mode.

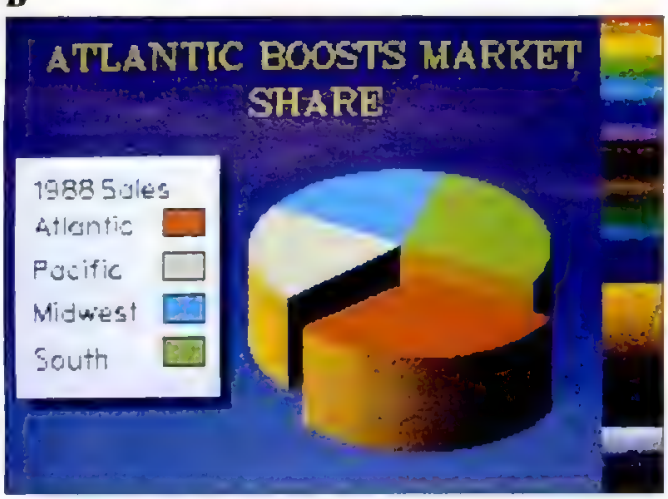
A

VGA: 640 by 480 pixels

C

EGA: 640 by 350 pixels

B



VGA: 320 by 200 pixels

D

CGA: 320 by 200 pixels

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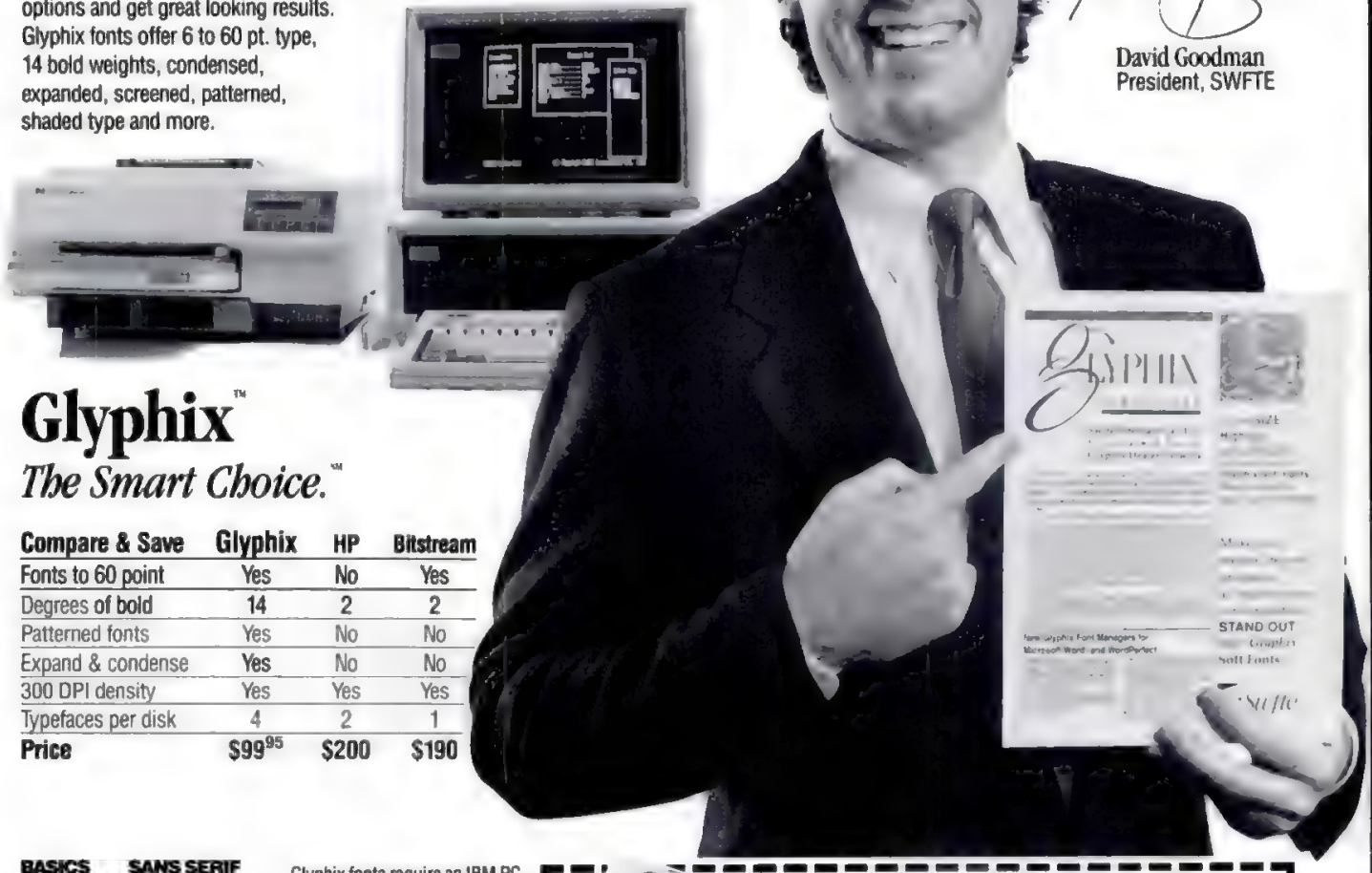

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80-column VGA Monochrome Text
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CIRCLE 101 ON READER SERVICE CARD

at the direct palette access test. Both BIOS and direct-memory-writing performance on the VGA/H was slower than average.

The VGA/H is the board to choose for upgradability. It will allow you to move up to new display standards whenever you can afford a new monitor. It's the only board that lets you go backward to a digital monitor or forward with its VGA Video Feature Connector.

TATUNG CO. OF AMERICA INC.

Tatung VGA Platinum Card

Platinum is useful and beautiful—the stuff of jewelry and catalytic converters. Tatung's VGA Platinum Card shares those qualities, if embryonically. The $449 board is a practical product that supports all major video standards from MDA up to VGA, extending up to 800 by 560 pixels in 16 colors. It's beautiful, too, in its ability to automatically adjust itself to the standard demanded by your software. But the raw metal in the Platinum Card needs more work to fulfill its potential.

The 7-inch-long Platinum Card is a product of technological convergence, built from both Chips and Technologies' VGA chip and ATI Technologies' VLSI circuit for lower-resolution work. Its 256K RAM is rated at 120 nanoseconds, and it uses an Inmos DAC.

REGISTER-LEVEL MATCH A register-level rather than hardware match for the VGA standard, the Platinum card's expansion connector follows the EGA standard. In fact, the Platinum Card claims full hardware compatibility with the EGA standard and only a BIOS-level match for the MDA, Hercules Graphics, and CGA standards. It even puts images from any standard up to EGA on lesser CGA displays and transposes monochrome VGA screens to color displays.

Both digital DB-9 and analog DB-15 connectors are installed on the Platinum Card's retaining bracket. An eight-bank DIP switch, accessible through a cutout in the bracket, adjusts the card to match monitors that don't fit the analog VGA standard. VGA-spec displays (but not MultiSync-style monitors) automatically take command and override the switch settings. An RF output for a television modulator is also available on the Platinum Card.

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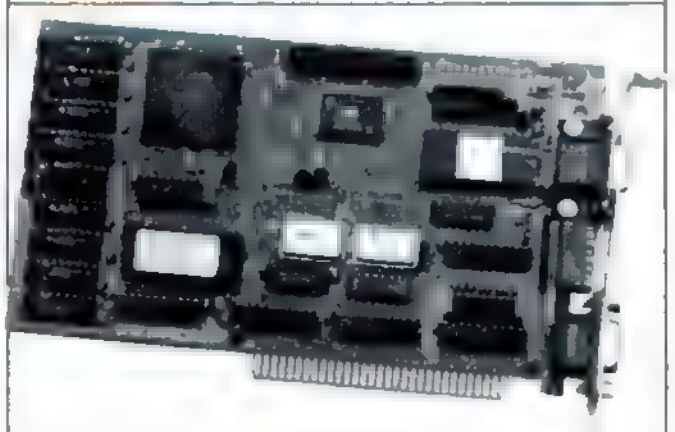

Tatung VGA Platinum Card
Tatung Co. of America Inc.
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Long Beach, CA 90810
(800) 421-2929
(213) 979-7055
List Price: $449
Requires: PC, XT, AT, or compatible, or PS/2 Model 30.
In Short: A short card that's register compatible with the VGA standard and backward compatible with all previous major video standards and monitors. It offers several additional resolutions up to 800 by 560 in 16 colors.

CIRCLE 694 ON READER SERVICE CARD

An entire row of badly documented jumpers lines the top half of the rear edge of the card. The accompanying manual lists the function of only one of the six sets, which sets the card's base address.

BEYOND VGA Beyond the VGA standard, the Platinum Card offers eight modes of its own. Four push horizontal resolution to 1,056 pixels to put 132 columns of text on MultiSync-style displays, at either 25 or 44 columns (200 or 354 pixels) deep. Also available are two 640- by 528-pixel modes. At its sharpest, the Platinum Card produces graphics at the odd aspect ratio of 800 by 560 in 16 colors.

Tatung supplies a control program that allows manual shifting of video modes and also includes a screen saver that blanks your monitor after a predetermined period of system inactivity. Programs supported by Tatung drivers include *AutoCAD*, *Microsoft Windows*, *GEM*, *Ventura Publisher*, and *Lotus 1-2-3* (in 132-column text mode).

Like IDS's Intelligent VGA Boards, the Platinum Card produced some of the slowest times in the PC Labs performance and benchmark tests. It also fared as well as the IDS board in passing most of the PC Labs VGA compatibility tests. All in all, the Platinum Card is not as lustrous as it could be. With some polishing, however, it could be a strong VGA contender.

TAXAN USA CORP.

Ultra-Grafix VGA Model 580 Card

Taxan's Ultra-Grafix VGA Model 580 Card earns its name by going beyond VGA hardware compatibility with an enhanced 800 by 600 16-color mode for MultiSync-style monitors. The $395 product also rates as a sub-VGA board, endowed with the ability to handle any major video standard below the VGA level—including MDA, CGA, MCGA, and EGA—and put a likeness of its images on any monitor it works with (VGA and analog MultiSync-style only). It plugs into nearly any PC (except for the early 64K system board model), XT, AT, PS/2 Model 30, or compatible.

Based on a Paradise Systems VLSI chip and an Inmos DAC, and equipped with 256K of 120-nanosecond memory, the Ultra-Grafix VGA Model 580 Card bears a striking resemblance to the Paradise VGA Plus. As with the Paradise board, the Ultra-Grafix VGA is 5¼ inches long and uses an 8-bit interface. It also includes an IBM-standard VGA Video Feature Connector at its top edge.

The only monitor connection supplied is a DB-15 connector suitable for analog VGA-standard monitors and MultiSync-style displays equipped with suitable adapter cables. The Ultra-Grafix VGA automatically senses whether it's attached to a color or monochrome VGA display and limits its VGA display modes accordingly. The board will, however, map Hercules monochrome graphics to a color VGA system.

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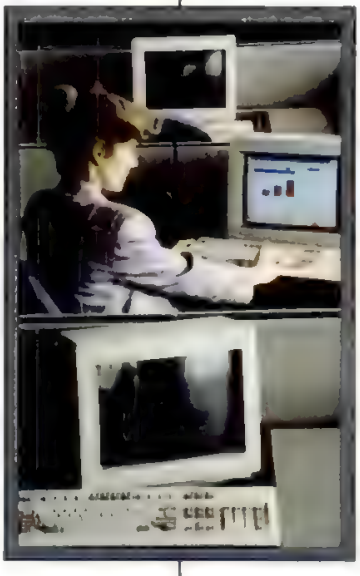

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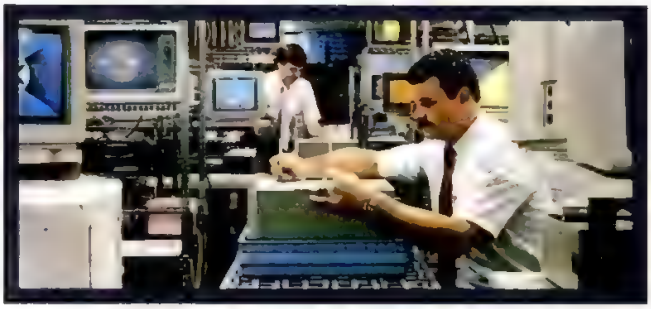

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CIRCLE 539 ON READER SERVICE CARD

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THE NEW 20MHz 386 SYSTEM 310.

The top of the line. It's the highest performance 80386 computer available, faster than the IBM† PS/2† Model 80 and the Compaq† 386/20. It runs at 20 MHz, with the latest 32-bit architecture for maximum performance. And it's completely MS® OS/2 compatible. Since it also has Intel's† Advanced 82385 Cache Memory Controller, and high performance disk drives, the System 310 is ideal for intensive database management, complex research and development, CAD/CAM, and desktop publishing. As a network file server the system offers an unbeatable combination of price and performance.

Standard Features:

Intel† 80386 microprocessor running at 20 MHz.
1 MB of 80 ns 32-bit RAM expandable to 16 MB without using an expansion slot.
Advanced Intel 82385 Cache Memory Controller with 32 KB of high speed static RAM.
Socket for 20 MHz 80387 coprocessor.
5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
Dual diskette and hard disk drive controller.
Enhanced 101-key keyboard.
1 parallel and 2 serial ports.
200-watt power supply.
Real-time clock.
8 expansion slots (6 available with hard disk drive controller and video adapter installed).
Dell System Analyzer.
MS-DOS® and MS OS/2 compatible.
Security lock with locking chassis.
12 month on-site service contract (Available on complete systems).

Options:
1 MB RAM upgrade kit.
20 MHz Intel 80387 math coprocessor.
2 MB or 8 MB memory expansion boards.

SYSTEM 310	With Monitor and Adapter		
Hard Disk Drives	VGA Mono	VGA Color	VGA Color Plus
40 MB-28 ms	$4,099	$4,299	$4,399
90 MB-18 ms ESDI	$4,899	$5,099	$5,199
150 MB-18 ms ESDI	$5,399	$5,599	$5,699
322 MB-18 ms ESDI	$7,399	$7,599	$7,699

THE NEW 20MHz 286 SYSTEM 220.

As fast as most 386 computers, at less than half the price—more power for the money than any other system. An 80286 system that runs at 20 MHz, with less than one wait state. Completely compatible for both MS-DOS and MS OS/2 applications (it runs OS/2 faster than IBM PS/2 Model 80), and with a remarkably small footprint, the System 220 is the ideal executive workstation for database management, business, or sophisticated connectivity applications. The system uses page-mode interleaved memory; the page-mode RAM operates at less than one wait state, and inter-leaving results in a performance increase of about 15 percent.

Standard Features:

80286 microprocessor running at 20 MHz.
1 MB of RAM expandable to 16 MB (8 MB on system board).
Integrated diskette and VGA video controller on system board.
One 3.5" 1.44 MB diskette drive.
Integrated high performance hard disk interface on system board.
Enhanced 101-key keyboard.
1 parallel and 2 serial ports.
LIM 4.0 support for memory over 1 MB.
Real-time clock.
Three full-sized AT† compatible expansion slots.
Socket for 80287 coprocessor.
Dell System Analyzer.
MS-DOS and MS OS/2 compatible.
Security lock with locking chassis.
12 month on-site service contract (Available on complete systems).

Options:
3.5" 1.44 MB diskette drive.
Intel 80287 coprocessor.
1 MB RAM upgrade kits.

SYSTEM 220	With Monitor		
	VGA Mono	VGA Color	VGA Color Plus
One Diskette Drive	$2,299	$2,499	$2,599
40 MB-29 ms Hard Disk	$2,999	$3,199	$3,299
100 MB-29 ms Hard Disk	$3,799	$3,999	$4,099

THE NEW 12.5MHz 286 SYSTEM 200.

A great value in a full-featured AT compatible. An 80286 computer running at 12.5 MHz, this system is completely MS OS/2 compatible. It's ideal for general business applications, as well as software development, local area networks, CAD/CAM, and desktop publishing. The System 200 offers high speed drive options, industry standard compatible BIOS, and on-site service. At these low prices, the System 200 is the best value in the 80286 marketplace. As Executive Computing said of this computer's predecessor, "If faster processing speed and low cost are two key issues affecting your purchase decision, this machine might be the ideal choice for your office."

Standard Features:

Intel 80286 microprocessor running at 12.5 MHz.
640 KB of RAM, expandable to 16 MB (4.6 MB on system board.)
5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
Dual diskette and hard disk drive controller.
Enhanced 101-key keyboard.
1 parallel and 2 serial ports.
200-watt power supply.
Real-time clock.
6 expansion slots. (4 available with hard disk drive controller and video adapter installed).
Socket for 8 MHz 80287 coprocessor.
Dell System Analyzer.
MS-DOS & MS OS/2 compatible.
Security lock with locking chassis.
12-month on-site service contract (Available on complete systems).

Options:
512 KB RAM upgrade kit.
8 MHz Intel 80287 coprocessor.

SYSTEM 200	With Monitor and Adapter			
Hard Disk Drives	Mono	VGA Mono	VGA Color	VGA Color Plus
20 MB	$2,099	$2,299	$2,499	$2,599
40 MB-40 ms	$2,299	$2,499	$2,699	$2,799
40 MB-28 ms	$2,499	$2,699	$2,899	$2,999
90 MB-18 ms ESDI	$3,299	$3,499	$3,699	$3,799
150 MB 18 ms ESDI	$3,799	$3,999	$4,199	$4,299
322 MB 18 ms ESDI	$5,799	$5,999	$6,199	$6,299

THE NEW 8088 SYSTEM 100.

A full-featured, yet economical one-piece computer for office, school, or home. This system is fast, easy to use, and ready to run with Dell Enhanced MS-DOS 3.3, Microsoft® DOS Manager, and Microsoft Works software–more than a $400 value, included at no extra charge. Complete MS-DOS compatibility means you can run thousands of programs for business, personal finance, education, and entertainment. And the System 100 can grow, with the high quality options listed below. A price leader in 8088 technology, the System 100 boasts an innovative design that allows for more power, speed and convenience than most of its competitors.

Standard Features:

Intel 8088 microprocessor running at 9.54 MHz selectable to 4.77.
640 KB of RAM.
3.5" 720 KB diskette drive.
Diskette drive controller integrated on system board.
Integrated high-quality 84-key keyboard.
1 serial and 1 parallel port.
Two full-sized expansion slots available when video adapter is installed.
One half-sized expansion slot used for video adapter.
Socket for 8 MHz 8087 coprocessor.
Internal speaker with earphone jack and volume control.
Security Tie-Down bracket.
Dell Enhanced MS-DOS 3.3 Microsoft DOS Manager, Microsoft Works.

Options:
3.5" 720 KB diskette drive.
8 MHz Intel 8087.

SYSTEM 100	With Monitor and Adapter			
	Mono	CGA Color	VGA Mono	VGA Color
720 KB Diskette Drive	$1,099	$1,199	$1,299	$1,499
Two 720 KB Diskette Drives	$1,249	$1,349	$1,449	$1,649
20 MB Hard Disk	$1,599	$1,699	$1,799	$1,999

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We now offer a full line of PC-compatible dot matrix and laser printers. Our dot matrix printers range from inexpensive near-letter quality printers to the highest resolution printers available. Our laser printers include some of the fastest, most reliable printers ever made. All are 300 dots per inch, and all support serial and parallel interfaces. And all printers come with our 30-day money-back guarantee and a one year warranty.

LASER PRINTERS

Laser System 150 $5,995
15 pages per minute, text and graphics
1.5 MB standard memory, expandable to 2.0 MB
Dual 250-sheet input trays

Laser System 80 $3,195
8 pages per minute text and graphics
1.5 MB standard memory, expandable to 2.0 MB

Laser System 60 $2,195
6 pages per minute, text and graphics
1.5 MB standard memory, expandable to 2.0 MB

DOT MATRIX PRINTERS

Printer System 800 $699.95
Highest resolution text and graphics from a 24-wire dot matrix printer
Draft quality at 200 cps
Correspondence quality at 132 cps
Letter quality at 66 cps
Standard parallel and serial interfaces
Wide carriage

Printer System 600 $499.95
9-wire dot matrix
Draft quality at 240 cps
Near-letter quality at 60 cps
Standard parallel interface
12.6 KB Buffer (expandable to 28.6 KB)
Wide carriage

Printer System 300 $199.95
9-wire dot matrix
Draft quality at 144 cps
Near-letter quality at 36 cps
Four standard fonts
Paper parking
4 KB buffer
Standard Parallel interface

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With our unique manufacturing capabilities, we can build a system to your exact specifications. We offer monitors, modems, graphics boards, tape backups, hard drives, diskette drives, expanded memory boards, a serial mouse, and more. Call for details.

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CIRCLE 536 ON READER SERVICE CARD

WHY SETTLE FOR A MERE VGA?

So you say that VGA is not good enough for you. You say you want more pixels—something like 1,024 horizontally and 768 vertically. And you also want more colors. You're dissatisfied that the VGA allows 256 simultaneous colors only with the puny 320 by 200 mode. You want 256 simultaneous colors at the full 1,024 by 768 resolution.

Remember this number: 8514.

The 8514/A Display Adapter, 8514 Memory Expansion Kit, and 8514 Color Display comprise IBM's high-end graphics video system for the PS/2 Models 50, 60, and 80. The maximum resolution is 1,024 by 768 with 256 colors selected from 262,144. The 8514/A also contains a graphics coprocessor that speeds up the drawing operation. Although it is a little high for most users, the $3,100 cost of the complete 8514/A system is competitive with other video boards and monitors of comparable resolution and color capability.

The 8514/A consists of two sandwiched boards that occupy a special slot in the PS/2 Micro Channel architecture bus. Although you can use any PS/2 monitor with the 8514/A, you need the 8514 Color Display for the 1,024 by 768 resolution.

MEMORY AND MODES The 8514/A comes with 512K of video buffer memory, organized in four color planes of 128K each. This gives you 16 simultaneous colors. The 8514 Memory Expansion Kit increases the on-board memory to 1MB. The extra memory adds four more color planes, for 256 simultaneous colors. (One megabyte is enough for a resolution of 1,024 by 1,024 with eight color planes; the 8514 can use the extra memory for storing fonts and bitmaps.)

The 8514/A supports only four graphics modes: a 640 by 480 mode and three 1,024 by 768 modes (each using a different font size). These are called the "advanced function" graphics modes. In the 1,024 by 768 mode, the display is interlaced but at a fairly high frame rate of 43 Hz. I did not notice any flickering.

Microsoft Excel *running under* Windows *on the IBM 8514/A Display Adapter. The 8514 driver will be available with* Windows *2.1.*

The 8514/A occupies a special bus slot with an additional connector that supplies video signals from the PS/2 system-board VGA to the 8514/A board. When the 8514/A is not in an advanced-function mode, it simply routes the video signals to the monitor attached to the adapter. Thus, the 8514/A does not replace the VGA but works in conjunction with it. You still have all the CGA, EGA, and VGA video modes supported by the VGA without any special VGA hardware on the 8514/A.

You can also use the 8514/A with two monitors. One monitor (usually the 8514 Color Display) is attached to the 8514/A adapter; the other (presumably one of IBM's other PS/2 color monitors) is connected to the VGA on the system board. For all the VGA video modes (including the CGA and EGA compatibility modes), both monitors show the VGA output. But when the 8514/A is switched into an advanced-function mode, the two adapters work independently. This flexibility is particularly useful in some dual-screen CADD programs or in program development work for running both a debugger on one screen and the program on another.

FUNDAMENTALLY DIFFERENT The biggest difference between the 8514/A and the VGA is the 8514 graphics coprocessor. The video buffer memory in the VGA is addressable by the PC's microprocessor like any other memory in the system. An application program writes text or graphics to the video display as if it were writing the characters or bits to memory. This configuration is simple enough, but it burdens the application program (or the graphics interface software) with the time-consuming job of writing the graphics images to the adapter memory.

The 8514/A is fundamentally different. The 1MB of video buffer memory in the 8514/A is *not* directly addressable by the PC's microprocessor. Instead, the board contains a graphics coprocessor that performs many high-level functions, including the drawing of lines (with selectable styles), filled areas (with selectable patterns), and text.

Basically, an application program tells the 8514/A board what to draw and the board does all the actual drawing. To draw a rectangle on the 8514, an application program need only specify the coordinate position of the upper-left corner, the width, the height, and the color. The graphics coprocessor does the rest.

FACT FILE

IBM 8514/A Display Adapter
IBM Corp.
Consult your local authorized IBM dealer.
List Price: $1,290
Requires: PS/2 Model 50, 60, or 80.
Options: The 8514 Memory Expansion Kit (required for 256 simultaneous colors rather than 16). The 8514 Color Display (required for 1,024 by 768 resolution)
In Short: The 8514/A is IBM's high-end video board for the PS/2 series. The resolution is 640 by 480 or 1,024 by 768 (depending on the monitor) with 16 or 256 colors (depending on the amount of memory on the board). The board includes hardware-assisted high-level drawing functions.
CIRCLE 661 ON READER SERVICE CARD

IBM 8514 Memory Expansion Kit
IBM Corp
Consult your local authorized IBM dealer.
List Price: $270
Requires: The 8514/A Display Adapter.
In Short: Sixteen 32K graphics memory chips that plug into an 8514/A to give you 256 simultaneous colors rather than 16.
CIRCLE 660 ON READER SERVICE CARD

IBM 8514 Color Display
IBM Corp
Consult your local authorized IBM dealer.
List Price: $1,550
Requires: PS/2 Model 30, 50, 60, or 80.
In Short: The 8514 display is the only PS/2 monitor capable of 1,024 by 768 resolution. It can be attached to any PS/2 computer, but it's really designed for use with the 8514/A adapter. IBM says the monitor measures 16 inches diagonally and provides "high contrast," but don't believe it.
CIRCLE 659 ON READER SERVICE CARD

THE PGC STORY The 8514 is not the first graphics coprocessor board IBM has offered for personal computers. When IBM introduced the EGA in 1984, it also introduced the Professional Graphics Controller (PGC). The PGC supported 640 by 480 resolution with 256 simultaneous colors—out of 4,096—and included a CGA-emulation (but not an EGA-emulation) mode. The board and monitor cost $4,300, and the board required two PC-XT or PC AT slots.

The PGC was a CADD board with sophisticated three-dimensional vector-based drawing functions. Although the PGC eventually was supported by many CADD applications (and also became something of a standard when certain video board manufacturers designed PGC superset boards), it had almost no mainstream application support.

One of the more serious deficiencies in the PGC was its inability to do bit-block transfers ("bitblts") between microprocessor memory and video memory. Bitblts are used quite frequently in windowing environments. For example, moving a mouse pointer across a graphics screen requires several bitblts for each new position of the pointer.

The high-level graphics functions in the 8514/A are not as sophisticated as those in the PGC. The 8514/A is rather a general-purpose graphics board and does only two-dimensional drawing. But it does support bitblts. The 8514/A is particularly well suited to a graphics-based windowing system such as *Microsoft Windows* or the OS/2 Presentation Manager. (The 8514/A will be supported under *Windows*, Version 2.1, and will quite likely be supported under the initial release of the OS/2 Presentation Manager, scheduled for October.)

DRAWING FUNCTIONS Controlling the drawing functions of the 8514/A is easily accomplished by making use of a high-level software interface—a RAM-resident program called HDILOAD .EXE that comes on a floppy disk supplied with the adapter board. The program is copied to the hard disk during installation and can be loaded into memory in the AUTOEXEC.BAT file. HDILOAD gives applications access to 59 high-level drawing functions. The entry points for these functions are obtained through software interrupt 7Fh.

For programmers who wish to explore the 8514/A, IBM sells a 52-page Programmer's Guide (including a disk with some utilities and demonstration programs) and a 140-page Technical Reference manual that documents the 59 functions. It's easiest to use the 8514/A software interface from programs written in C. Two C header files, an assembly language binding routine, and a demonstration program written in C are supplied with the 8514/A adapter.

The drawing functions have names such as HLINE (to draw a line) and HRECT (to draw a rectangular area). Each of these function names is actually a C macro that calls a function in the assembly language binding routine. The binding routine then calls the appropriate entry point in HDILOAD, and HDILOAD accesses the hardware of the 8514/A through registers.

To test the speed of the 8514 graphics coprocessor, I wrote a C program that draws several thousand randomly sized rectangles filled with a solid, randomly chosen color. For the VGA in the 640 by 480 graphics mode, I used a highly optimized rectangle-drawing routine written in assembly language. For the 8514/A in the advanced-function 640 by 480 mode, I called the functions HSCOL (select a color) and HRECT (draw a rectangle) directly from my program.

LIBERATE YOUR PROCESSOR On a 20-MHz PS/2 Model 80, the VGA routine took an average of 8.3 milliseconds per rectangle. On the 8514/A, the time dropped to 2.7 ms. per rectangle, about three times as fast. Moreover, much of this time is spent by the 8514/A board doing the drawing. The PS/2 microprocessor is freed up after about 0.8 ms. Thus, the microprocessor actually spends about one-tenth as much time drawing the rectangle on the 8514/A as on the VGA.

With the introduction of the OS/2 Presentation Manager in October, graphics will become an increasingly important part of the PC's future. The 8514/A is the right board at the right time. It is not quite at the right price, but that problem is likely to be solved by other hardware manufacturers. Look for a lower-cost substitute for IBM's poor 8514 display in the near future, and at least one 8514/A clone after that.—**Charles Petzold**

Charles Petzold is a contributing editor of PC Magazine.

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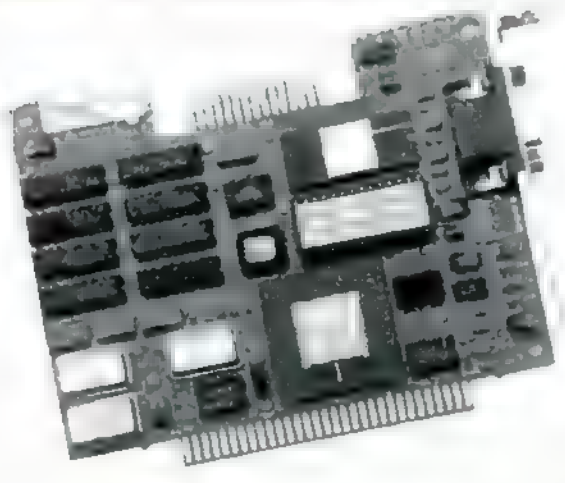

Ultra-Grafix VGA Model 580 Card
Taxan USA Corp.
18005 Cortney Ct.
City of Industry, CA 91748
(800) 544-3888
(818) 810-1291
List Price: $395
Requires: PC, XT, AT, or compatible, or PS/2 Model 30.
In Short: A VGA-hardware-compatible short card that offers backward compatibility with previous video standards along with an enhanced-resolution 800 by 600 mode in 16 colors. For VGA and MultiSync-style displays only.
CIRCLE 693 ON READER SERVICE CARD

there's no need to select monitor types, it uses no DIP switches and only one hardware jumper, which selects whether the board will have its 800 by 600 mode accessible or keep its Video Feature Connector completely IBM compatible.

To switch the Ultra-Grafix between some of its modes, you must use a special utility program, VGAPLUS, that Taxan supplies along with the board. The 800 by 600 resolution mode of the Ultra-Grafix VGA requires you to have a MultiSync-style monitor and compatible software. Drivers are included with the board to enable the following program to use this ultra-mode: *Microsoft Windows* (Version 2.0 only), *GEM*, *AutoCAD*, *CADvance*, *Ventura Publisher*, and *Framework II*. In addition, drivers are included to use *Framework II*; *WordStar*, Version 3.3, *WordStar Professional*, Release 4.0, and *WordPerfect* in the two 132-column text modes (25- and 43-row) that the Ultra-Grafix VGA can display.

ABOVE AVERAGE In testing, the Taxan Ultra-Grafix VGA ranked above average in its VGA hardware compatibility. Its times in the PC Labs performance tests ranked among the fastest of the boards we tested. In the PC Labs video benchmark tests, the Ultra-Grafix was an average performer. And like the Paradise VGA Plus and Tecmar VGA, the Ultra-Grafix passed six out of eight of the PC Labs VGA compatibility tests, making it one of the most compatible boards that we tested.

Understandably, the Taxan Ultra-Grafix VGA rates as well as the very similar Paradise VGA Plus in VGA compatibility and performance because of the circuitry and chips the two boards share. If you have a VGA-style monitor, the Ultra-Grafix would be a good alternative to the IBM PS/2 Display Adapter. If you have a MultiSync-style display, its higher resolution capabilities make it an even better choice.

TECMAR INC.
Tecmar VGA

Building on past success with its Graphics Master, Tecmar has now nailed VGA register compatibility and even higher resolution—up to 800 by 600 pixels in 16 colors—onto its $395 VGA board. Along the way, the VGA has gathered up all lesser standards, including EGA BIOS compatibility and MDA, Hercules Graphics, and CGA register-level compatibility. The board works with nearly all non–Micro Channel IBM computers and compatibles, including all PCs (except for 64K system board models), XTs, ATs, and the PS/2 Model 30.

The 5.4-inch board misses full VGA hardware compatibility in that it lacks any provision for expansion at all, let alone a VGA Video Feature Connector. The Tecmar VGA is based on a Toshiba VLSI video chip and 256K of 100-nanosecond RAM. Conspicuously absent is the Inmos DAC used by IBM and all other clones. Both digital DB-9 and analog DB-15 output connectors are mounted on the card-retaining bracket.

SIX-BANK DIP SWITCH Peeking through a cutout in this bracket is the six-bank DIP switch that's used for setting up

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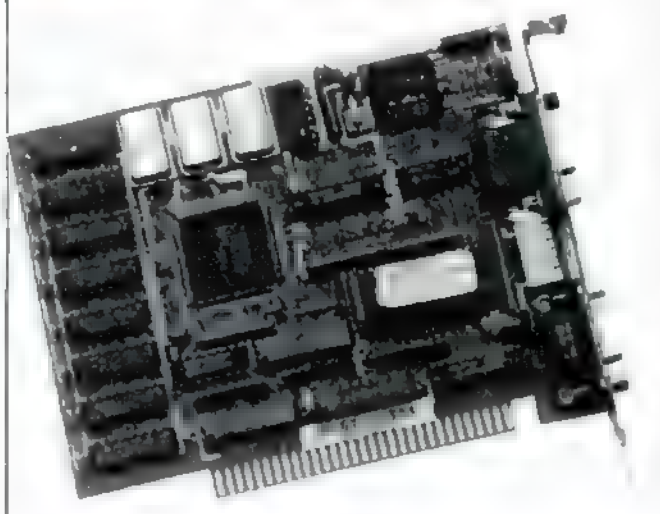


Tecmar VGA
Tecmar Inc
6225 Cochran Rd.
Solon, OH 44139
(800) 624-8560
(216) 349-1009
List Price: $395
Requires: PC, XT, AT, or compatible, or PS/2 Model 30.
In Short: A short card that's register compatible with the VGA standard as well as all major previous video standards and display types. Beyond the VGA standard, the board can achieve resolution up to 800 by 600 in 16 colors.
CIRCLE 692 ON READER SERVICE CARD

the Tecmar VGA. These switches are used to adjust for the monitor that's connected to the board and its default mode of operation. Unlike IBM-standard VGA boards, which automatically adapt to color or monochrome VGA displays, the Tecmar VGA requires that you set one of these switches as well as the single on-board jumper.

Once the host system is booted and running, the operating mode of the Tecmar VGA can be changed with a utility that's supplied with the board. This software enables the board to display text and graphics made by any supported video standard on any monitor that can be connected to it. The program, called VGA, is both command and menu driven, so it's easy to use and yet can be wielded in batch files as well.

Beyond the VGA standard, the Tecmar VGA supports graphics modes with either 800 by 440 or 800 by 600 pixels in 16 colors chosen from a palette of 64. In addi-

Coming from Lotus.

EDITOR'S CHOICE

• Close but no cigar

If your goal is true VGA hardware compatibility with IBM's Personal System/2, you won't find a winner here. Although all of these VGA boards aspire to it, none really reach it. All of the products we examined suffer from at least one compatibility shortcoming, be it only in smooth diagonal scrolling.

Should you be willing to sacrifice the last iota of hardware compatibility—after all, there's neither guarantee nor threat that any software company will exploit all the VGA features we've tested for—you'll find plenty of good choices.

If you already have a VGA or MultiSync-style display (or regard getting one as an inevitability) and demand a VGA Video Feature Connector as a hardware compatibility prerequisite, try the Compaq, Paradise, Taxan, or Tecmar products; the Compaq (which was an Editor's Choice in the February 16, 1988, issue) is the top choice because of its speed.

If you want to plug your new VGA board into your display and upgrade later (but don't need a VGA Video Feature Connector), choose the IDS, Orchid, Everex, or Tatung. We give the edge to the IDS Intelligent VGA—despite its $50 price premium—because of its greater resolution potential, won with its 512K RAM.

Only the Sigma VGA/H offers both forward and backward hardware compatibility. If that's what you require, it's got to be your choice.

Because it fell furthest from the mark, we consider the Video Seven VEGA VGA only an enhanced EGA board with VGA BIOS compatibility. And the IBM PS/2 Display Adapter just costs too much.

tion, text modes with 100 columns by 43 or 55 rows and 132 columns by 25 rows are available. The beyond-VGA resolutions require MultiSync-style displays. With VGA-standard monitors, the maximum number of columns in text mode is limited to 120.

To accommodate the advanced resolutions and display modes of its VGA, Tecmar includes several drivers with it, all installable through the VGA program. Among these are drivers for *AutoCAD*, *GEM* (Versions 2.1 and 2.2), *Lotus 1-2-3* (Releases 1A and 2), *Symphony*, *Ventura Publisher* (Version 1.1), and *Microsoft Windows* (Versions 1.0 and 2.0). Tecmar also includes a GSS*CGI driver that supports several dozen CAD, scientific, engineering, and other graphics programs.

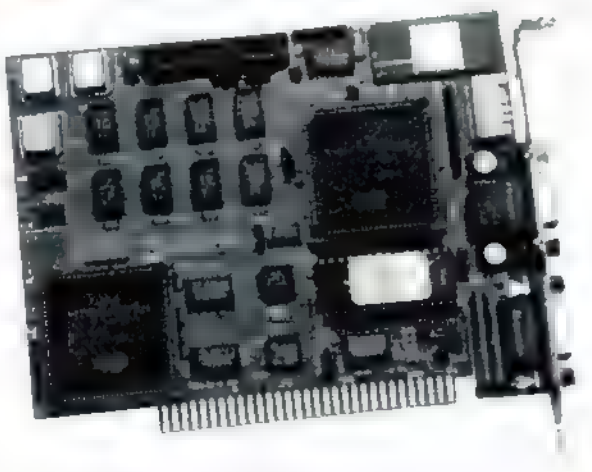
ALL IN ALL The Tecmar VGA turned in average performance in the PC Labs suite of performance and benchmark tests. It passed six of the eight PC Labs VGA compatibility tests, which means it keeps company with the Paradise VGA Plus and Taxan Ultra-Grafix boards. The Tecmar VGA is a very good product, albeit one that lacks expansion abilities. For some people, however, it may not prove to be as convenient as the automatically configuring boards that don't require running programs when switching from Hercules to VGA graphics. In most cases, however, you'll want to install your graphics software for the VGA standard, and you'll never need to switch.

VIDEO SEVEN INC.
VEGA VGA

The board for all seasons—any standard, any monitor, any time—that's what Video Seven's VEGA VGA promises to be. More than that, the $499 VEGA adds more resolution, colors, and columns to the existing standards and backs it all up with a 3-year hardware warranty.

The VEGA supports MDA, Hercules Graphics, CGA, EGA, and VGA standards down to the hardware register level in any PC (except for 64K system board models), XT, AT, or PS/2 Model 30. Beyond the VGA standard, it offers 752- by 410- and 800- by 600-pixel resolution in 16 colors. In text modes, it permits up to

FACT FILE



VEGA VGA
Video Seven Inc.
46335 Landing Pkwy.
Fremont, CA 94538
(800) 238-0101
(800) 962-5700 (in Calif.)
List Price: $499
Requires: PC, XT, AT, or compatible, or PS 2 Model 30.
In Short: A short card that's nearly register compatible with the VGA standard as well as all major lower video standards and monitor types. Capable of automatically setting itself for the proper type of monitor and display mode with resolution up to 800 by 600 in 16 colors.

CIRCLE **691** ON READER SERVICE CARD

60 lines of 80-column text or 43 lines of 132-column text and up to eight simultaneous downloaded fonts. It lacks only the 640 by 480 MCGA two-color mode of the PS/2 Models 25 and 30.

Not only does the VEGA support all common monitor types up to their resolution limits, but it can also automatically discern between most of them and configure itself appropriately. Similarly, it automatically adapts its hardware mode to that of the software you're running.

COMPACT DESIGN All of these functions are achieved on an 8-bit card that's only 5.4 inches long, able to fit into XT short slots. Two proprietary Video Seven VLSI chips, an Inmos DAC, and a handful of surface-mount chips make up its circuitry. Its 256K of memory is rated at 120 nanoseconds.

Strictly speaking, the VEGA is register and not hardware compatible with the VGA standard. In place of the VGA Video

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■ VGA BOARDS

Feature Connector, it has a 32-pin connector that follows the EGA expansion standard. The VEGA also includes a header for an EGA-compatible light pen port.

Both DB-9 and DB-15 connectors for digital and analog displays are supplied. Digital monitors are limited to a 64-color palette even in VGA modes; up to 256 simultaneous colors can be displayed on analog screens. The 752- by 410- and 800- by 600-pixel modes require MultiSync-style displays.

COMPLEX CONFIGURATION Setting up the VEGA can be complex, owing to seven jumper sets and a six-bank DIP switch. The jumpers mostly are for configuring the VEGA to match your system—for instance, matching XT slot 8, changing the base address, and selecting whether you use a color or monochrome monitor. The DIP switches, accessible through a cutout in the card-retaining bracket, match some monitors that VEGA cannot discriminate between, defeat its automatic monitor-matching ability, and select the boot mode of the board between EGA/VGA mode and CGA/MDA mode.

Video Seven includes a general control utility, VEGA, that governs Hercules and CGA compatibility and incorporates a "screen-saver" function that blanks your monitor screen after a predetermined period of system activity. In addition, drivers for *AutoCAD* and *Lotus 1-2-3* (Releases 1A and 2), as well as an enhanced version of ANSI.SYS, come with the VEGA.

In the PC Labs performance and benchmark tests, the VEGA did not distance itself from the pack, turning in performance results that fell within the midrange of the boards we tested. Moreover, it demonstrated several problems when executing the PC Labs VGA compatibility tests and passed only four out of the eight tests. In that its hardware compatibility with the VGA standard is doubtful, the VEGA is perhaps best regarded as an enhanced EGA card that should work with most VGA software and will work with all VGA displays. If you have doubts, its money-back compatibility guarantee should reassure you.

Winn L. Rosch is a contributing editor of PC Magazine.

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VGA

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PC COMMUNICATIONS COMES OF AGE

Script languages put the power of programmers' tools behind your communications tasks

The process of transferring files from one PC to another is not the black art it once was. While programmers continue to dabble in protocol development, users have at their disposal an increasing number of tools and features aimed at making file transfers easier and more efficient.

A new generation of software has emerged to redefine the high end of the communications market. First on the scene were *Ascom IV*, *Relay Gold*, and *Relay Silver*, which supplemented the structure and command logic of their predecessors with new levels of functionality. Then came *Smartcom III* and *Crosstalk Mk.4*, sporting familiar names but bearing little resemblance to their older siblings. Two features in particular define this new generation of communications software: multitasking that permits multiple communications sessions (as in a multiuser bulletin board), background file transfer (while running another applications program), or both; and a script language that can rival programming languages for versatility.

In this issue we examine 21 programs with script languages you can use to automate your communications or even build new features into your system.

DESIGNER COMMUNICATIONS

The programs we reviewed—*Ascom IV*, *BitCom*, *Boyan*, *Crosstalk Mk.4*, *Crosstalk XVI*, *Freeway Advanced*, *HyperAccess*, *Lync*, *MEX-PC*, *Mirror II*, *ProComm*, *ProComm Plus*, *Professional-YAM*, *Ptel*, *Qmodem*, *Relay Gold*, *Relay Silver*, *Respond/Async*, *SideTalk*, *Smartcom III*, and *Softerm*—range in price from $35 to $250 and offer robust script languages that are suitable for general-purpose communications and that include commands for flow control and error handling. We did not look at programs with limited script languages that do little more than log on to a system.

Script languages fall neatly into three categories: minimal, advanced, and new-generation. Minimal script languages (such as those in *Boyan*, *Crosstalk XVI*, and *ProComm*) have relatively few commands and tend to be weak on flow control, error handling, arithmetic, file handling, and text manipulation. They will let you create scripts for straightforward communications tasks—such as logging on to a system or requesting information and capturing it to disk—but won't let you undertake an elaborate project like building your own bulletin board or set of menus.

Advanced script languages, like those in *SideTalk* and *HyperAccess*, are best thought of as communications-oriented programming languages, somewhat like *dBASE*'s database-oriented programming language. Most will let you build your own bulletin board or menus.

New-generation script languages are

the territory of the ground-breaking products like *Crosstalk Mk.4*, *Ascom IV*, *Smartcom III*, *Relay Gold*, and *Relay Silver*. They possess advanced script languages but also have more commands, so a given task can often be accomplished in fewer programming steps. *Smartcom III* even furnishes an on-line dictionary of commands and command syntax as an aid for writing scripts.

Many of the programs in all three categories offer a learn mode that creates scripts by recording both the user's keystrokes and the other system's response.

SPEED AND PROTOCOLS Script languages are undeniably useful but, when making a purchase, you must also be aware of the importance of protocols. More and better public-domain protocols are becoming widely available.

The ubiquitous Xmodem protocol is the only common tongue among communications programs, although Xmodem with CRC error checking tends to be more reliable, especially on noisy lines. However, Xmodem-CRC is marginally slower than standard Xmodem, so for transferring text on quality phone lines, Xmodem is probably the better choice.

Other Xmodem and Ymodem protocols offer batch file transfer and larger block size for faster file transfer. But if you need these, keep in mind that not everyone agrees on the names for these variations, which gives rise to some confusion. (For more information on protocols, see the diagram "Know Your Protocols.")

PROPRIETARY PROTOCOLS Several of the products we reviewed offer some noteworthy proprietary protocols. *HyperAccess*, for example, uses one that is optimized to work with high-speed modems but that, thanks largely to its data-compression techniques, offers impressive file transfer even at lower speeds. *Relay Gold* and *Relay Silver* furnish a proprietary protocol that can transfer files in both directions at once and still allow keyboard communications between systems.

Whether you're looking for lots of power and sophisticated features or ease of use and low price, you can probably find what you need among the products reviewed here.—**M. David Stone**

Ascom IV

Ascom IV, a $195 program from Dynamic Microprocessor Associates, is an old-timer among communications programs—its roots go back to CP/M. It doesn't sport the most modern accoutrements, but it is mature, solid, and compact enough to run from floppies.

To install, you copy the program to a hard disk and define the parameters of your communications environment. You can save configurations to files with different names, making it easy to maintain several different methods of connecting to a service. Similarly, you can specify an *Ascom IV* script for each entry in the dialing directory. This gives you flexibility in structuring your communication configurations. *Ascom IV* directly supports a wide variety of modems. There is a provision for enabling error correction, but only on Robotics and Microcom modems.

Ascom IV lets you list a series of files to either transmit or receive. It will process your lists sequentially, which can tremendously reduce the manual intervention needed to send multiple files. The program even checks to see that you won't overwrite a file on the receiving side and that the files exist on the transmitting side. *Ascom IV* maintains a log of all files received or sent and the status of the transmission (whether it was successfully transferred and, if not, why not).

Ascom IV uses function keys to navigate from mode to mode. The program usually displays the available function keys to remind you of your options, but not always: in some situations you simply have to remember the appropriate commands. A status line displays assorted messages; there's also a good, context-sensitive on-line help facility.

The terminal emulations include VT52, VT100, VT220, IBM 3101, ADM3A, Hazeltine 1500, Televideo 912, Data General Dasher 200 and ADDS Viewpoint. Similarly, the program supports a bountiful assortment of file-transfer protocols that include Xmodem, Xmodem-CRC, Xmodem 1K, Ymodem batch, and Kermit, as well as several proprietary protocols such as Ascom IV, Block, BlockV, and HSmodem for high-speed modems with error-checking hardware.

Ascom IV comes with log-on scripts for several commercial services; however,

One of Ascom IV*'s neatest features is a transaction log that saves information on all the files transmitted or received and notes whether each transfer was successful. The program even ascertains whether your transmission is overwriting a file on the receiving side.*

OUR REVIEWERS

Merv Adrian is a frequent contributor to *PC Magazine*.
Greg Alwang is a consultant with Soft Industries in Southington, Connecticut.
Patricia L. Becker is a consultant and writer at Soft Industries Corp., a Southington, Connecticut–based microcomputer consulting firm.
Bruce Brown is a principal at Soft Industries and a frequent contributor to *PC Magazine*.
Michael Brown is an accounting and microcomputer consultant based in Rockville, Maryland.
Kate Emery is a computer consultant with Soft Industries.
Glenn A. Hart is a contributing editor of *PC Magazine*.
David L. Hoffman is a microcomputer consultant and is vice president of the New York Personal Computer Users' Group.
Barbara Krasnoff, a frequent contributor to *PC Magazine*, is a former associate editor of *PC Magazine*.
Howard Marks is a New Jersey–based consultant specializing in communications and networks.
Alfred Poor is a senior consultant with Soft Industries and a frequent contributor to *PC Magazine*.
Alan Roth is a consultant with a New York telecommunications firm.
Walt Rowinsky is a free-lance technical writer based in Lakewood, Ohio.
John Schoenbeck lives and writes in Cleveland, Ohio.
Gary Stein is a computer and management information consultant in New York City.
M. David Stone is a contributing editor of *PC Magazine* and a consultant specializing in computer communications.
Donald B. Trivette is the author of *A Quick & Easy Guide to Dow Jones News/Retrieval*, published by Compute! Books.
Kenneth H. Werner is a software developer and the owner of a Houston, Texas, information consulting firm.

these only serve to get you logged on—no scripts to automate downloads or navigate through commercial services, for example, are supplied. The scripts included with some other advanced communications programs are far more sophisticated.

Ascom IV has its own editor for modifying scripts and for composing messages. One problem is *Ascom IV*'s consistent use of the End key to terminate operations. Although most editing commands are mnemonic, most PC editors use Home and End to move to the beginning and end of a line—a sure recipe for disaster in the *Ascom IV* editor. A few other commands aren't standard or easy to remember and aren't prompted anywhere on the screen (for instance, F6-Ins to insert a line). The files produced are standard ASCII, so you could use your own editor, but there aren't any provisions within *Ascom IV* to specify another editor as the default.

Ascom IV includes translation and filtration of both incoming and outgoing characters. An ASCII-to-EBCDIC configuration with the translation for this often-necessary mainframe conversion is supplied with the program.

SIMPLE FILE FOR BBS *Ascom IV* includes a much simpler script file to implement a modest bulletin board for sending and receiving messages. You can specify passwords, mailbox IDs, and one of three privilege classes for each approved caller. The highest priority class can gain access to *Ascom IV*'s internal DOS-like commands and can therefore send and receive files as well as messages.

The *Ascom IV* script language is more like assembly language than, say, BASIC or C. Hex constants are used, control characters must be inserted manually for return and line feed, and so on. As such, it's not as easy to learn or use as some other script languages. It's not particularly arcane or difficult if you've programmed before, but the novice may find *Ascom IV*'s script language tough sledding.

The language includes easy time and date manipulations, versatile communications and configuration commands, and very flexible file input/output commands. You can move within *Ascom IV*'s menu structure and modes and input or output to the screen or printer.

A reasonable assortment of DOS-like disk commands is available for file management. You can program subroutines, but the primary flow-control mechanism is via a comprehensive assortment of IF commands and GOTOs. This results in a lot of jumping around in the script code.

Scripts are parsed and compiled as they are loaded. You can precompile scripts if you wish and thereby speed up loading.

There are some oddities. For example, the manual refers to 300- or 1,200-bit-per-second modems, as if it hadn't been updated since 2,400-bps modems became widely available and inexpensive. Also, there are some errors in the script language examples. None of the rough edges were disabling, but we were surprised to see them in such a mature product.

Ascom IV offers a flexible script lan-

■ With *Ascom IV* you can precompile scripts if you wish and thereby speed up loading.

PC MAGAZINE FACT FILE

***Ascom IV*, Version 1.4**
Dynamic Microprocessor Associates
545 Fifth Ave., #1103
New York, NY 10017
(212) 687-7115
List Price: $195
Requires: 256K RAM, two disk drives, DOS 2.0 or later.
In Short: An old-timer with roots in CP/M and a spare user interface. Documentation needs updating, but script language will service users well. Not copy protected.

CIRCLE 690 ON READER SERVICE CARD

Know Your Protocols

From X to Z: a primer on what to expect—and what not to expect—from the protocol you're using.

Xmodem, Ymodem, and Zmodem protocols—with their variants, their similar names, and the debates over which name really goes with which protocol—can be a source of confusion in otherwise simple communications. Here's the lowdown on these protocols—what they are, what they do, and how they appear under other names. — **M. David Stone**

Xmodem

Xmodem is the common standard among communications programs. Every program reviewed here offers some version of Xmodem, which can fall back to checksum error checking.

SENDER	RECEIVER
Gets command to send, awaits prompt from receiver	Gets command to receive, requests checksum, sends message to start
Sends 128-byte block, 1-byte checksum	Computes checksum, compares, acknowledges
Sends next block	Computes checksum, compares, acknowledges
After last block, sends End of Transmission message	Acknowledges

Xmodem-CRC

Xmodem-CRC (cyclic redundancy checking) is still around in versions with no fallback to checksum error checking, but most programs with Xmodem-CRC can fall back to checksum. With such programs, the receiving side requests CRC error checking, and then asks for checksum if it doesn't get a block in response to its first request.

SENDER	RECEIVER
Gets command to send, awaits prompt from receiver	Gets command to receive, requests CRC error checking
Sends first 128-byte block, 2-byte CRC	Computes CRC, compares, acknowledges
Sends next block	Computes CRC, compares, acknowledges
Sends last block with End of Transmission message	Acknowledges

Xmodem 1K

Xmodem 1K is widely known as Ymodem, although Chuck Forsberg, creator of Ymodem, insists that true Ymodem includes a batch file feature (see Ymodem batch). By either name, Xmodem 1K sends larger data blocks and thus allows faster transfer over good phone lines. In theory, Xmodem 1K can use CRC or checksum error checking, and any combination of 128-byte blocks and 1K-byte blocks. Actually, some versions of Xmodem 1K do not fall back to checksum error checking, and some will not accept 128-byte blocks.

SENDER	RECEIVER
Gets command to send, awaits prompt from receiver	Gets command to receive, requests CRC error checking
Sends first 1,024-byte block with 2-byte CRC	Computes CRC, compares, acknowledges
Sends second block	Computes CRC, compares, acknowledges
After last block, sends End of Transmission message	Acknowledges

Ymodem batch

Ymodem batch (Ymodem, according to Forsberg's definition) is equivalent to Xmodem 1K with batch file transfer. This protocol sends a header containing the filename along with the file itself. In some implementations, the header also includes the file size and date. (Otherwise, the file date becomes the date of transfer and the size is rounded up to a multiple of the block size.)

SENDER	RECEIVER
Gets command to send, awaits information from receiver	Gets command to receive, requests CRC error checking
Sends filename and other header information, 2-byte CRC, and first 1,024-byte block	Computes CRC, compares, acknowledges
Sends next block	Computes CRC, compares, acknowledges
After last block, sends End of Transmission message	Acknowledges; requests next file with CRC error checking
Sends filename and other header information, 2-byte CRC, and first 1,024-byte block	Computes CRC, compares, acknowledges
After last block, sends End of Transmission message	Acknowledges; requests next file
Sends null pathname to indicate no more files	Acknowledges

YmodemG

YmodemG is a streaming protocol, built around the philosophy that no news is good news. It sends the entire file before waiting for an acknowledgement. If the receiving side detects an error in midstream, it aborts the transfer. YmodemG is not an error-correcting protocol; it is designed for use with high-speed modems, which have built-in error-correcting protocols.

SENDER	RECEIVER
Gets command to send, awaits prompt from receiver	Gets command to receive, requests streaming option with CRC error checking
Sends first filename and other header information, 2-byte CRC	Gives message to continue
Sends first 1,024-byte with block 2-byte CRC; sends second block; after last block, sends End of Transmission message	Acknowledges; requests next file with streaming option and CRC error checking
Sends second filename and other header information	Gives message to continue
Sends first and subsequent blocks; after last block, sends End of Transmission message	Acknowledges; requests next file with streaming option and CRC error checking
Sends null pathname to indicate no more files	

Zmodem (full streaming)

Zmodem is a streaming protocol that allows for error correction and error detection. The receiver can interrupt to request retransmission of garbled data. Zmodem is fast and is reliable on poor lines. If a link is broken during a transfer, Zmodem can redial and pick up the transfer without having to start over. Zmodem also includes file-management capabilities.

SENDER	RECEIVER
Sends Ready message, calls receiver	Tells sender which options the receiver possesses
Sends list of options to use, as well as header information	Tells sender to start transfer
Sends data header, data subpacket 1, and subsequent subpackets, followed by End of Transmission message	Acknowledges file; requests next file
Sends list of options to use, as well as header information	Tells sender to start transfer
Sends data header, data subpacket 1, and subsequent subpackets, followed by End of Transmission message	Acknowledges file; requests next file
Sends End of Files message	Acknowledges

guage and interesting and useful features (especially the multiple file specifications and transfer log). Its user interface is not as slick as that of some competitors, but it's workable. Its documentation is dry but complete. Overall, it's more suited to experienced users.—**Glenn A. Hart**

BitCom

If you bought a modem recently, you may have found a copy of *BitCom* at the bottom of the box. Fourteen modem distributors are bundling the program with their products, but even if *BitCom*, Version 3.5, doesn't come free to you, it's a good value at its list price of $69.

Version 3.5, a menu-driven program with a script language powerful enough to automate most communications tasks, is easy to start and easy to use. It supports the full Hayes command set, as well as transmission rates of 110 to 19,200 bits per second. It has built-in buffers and Xon/Xoff flow control, and its vendor, BIT Software, claims compatibility with 386 machines and the PS/2 series.

To get started, you copy *BitCom* onto a backup or, preferably, a hard disk, then enter "bitcom" at the DOS prompt. An opening menu presents four selections: go to the telephone directory, invoke a Script file, change the program's configuration, or issue a DOS command. Although *BitCom* does not come with a tutorial, it does offer context-sensitive on-line help on the F1 key, with complete information about the current screen and all selections and parameters. You'll find available operations indicated at the bottom of each screen.

You can keep as many as 32,000 listings, with phone numbers as long as 40 digits, in the directory. You invoke function keys and follow the instructions that appear on the screen to add or delete numbers. Other fields can be changed from default values as necessary, and you can edit the parameters at any time—even during a connection. For most fields, *BitCom* offers a series of appropriate values that are rotated or toggled by using cursor keys.

BitCom will redial until a connection is made. You can write a script to link numbers, so that if one is busy the next will be dialed. You can also dial from the DOS prompt and bypass the menus by entering "bitcom" and the record ID.

Once the connection is made, hitting the F2 key brings up an options menu, where you can choose to send or receive a file, change parameters, issue a DOS command, invoke a script file, or disconnect. You can specify a filename and capture the session, or you can save a screen snapshot with the press of a function key.

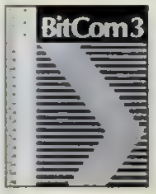
BitCom will allow you to change protocols before sending or receiving a file. After you enter the protocol and a pathname, the transfer begins. If you wish, you can automate the process by assigning file send/receive commands—including a prompt to request the pathname—to function keys. Some of the protocols *BitCom* supports include Xmodem with checksum, Xmodem-CRC, relaxed Xmodem, Xmodem 1K, Ymodem batch, and (new in Version 3.5) Kermit.

RUNNING APPLICATIONS If you invoke DOS, commands are executed in a DOS shell rather than from within *BitCom*, and when finished you must hit the

During communications you can use the options menu to send or receive files, and BitCom *will prompt you for the filename and allow you to change the protocol. You can automate this process by assigning send/receive commands to function keys.*

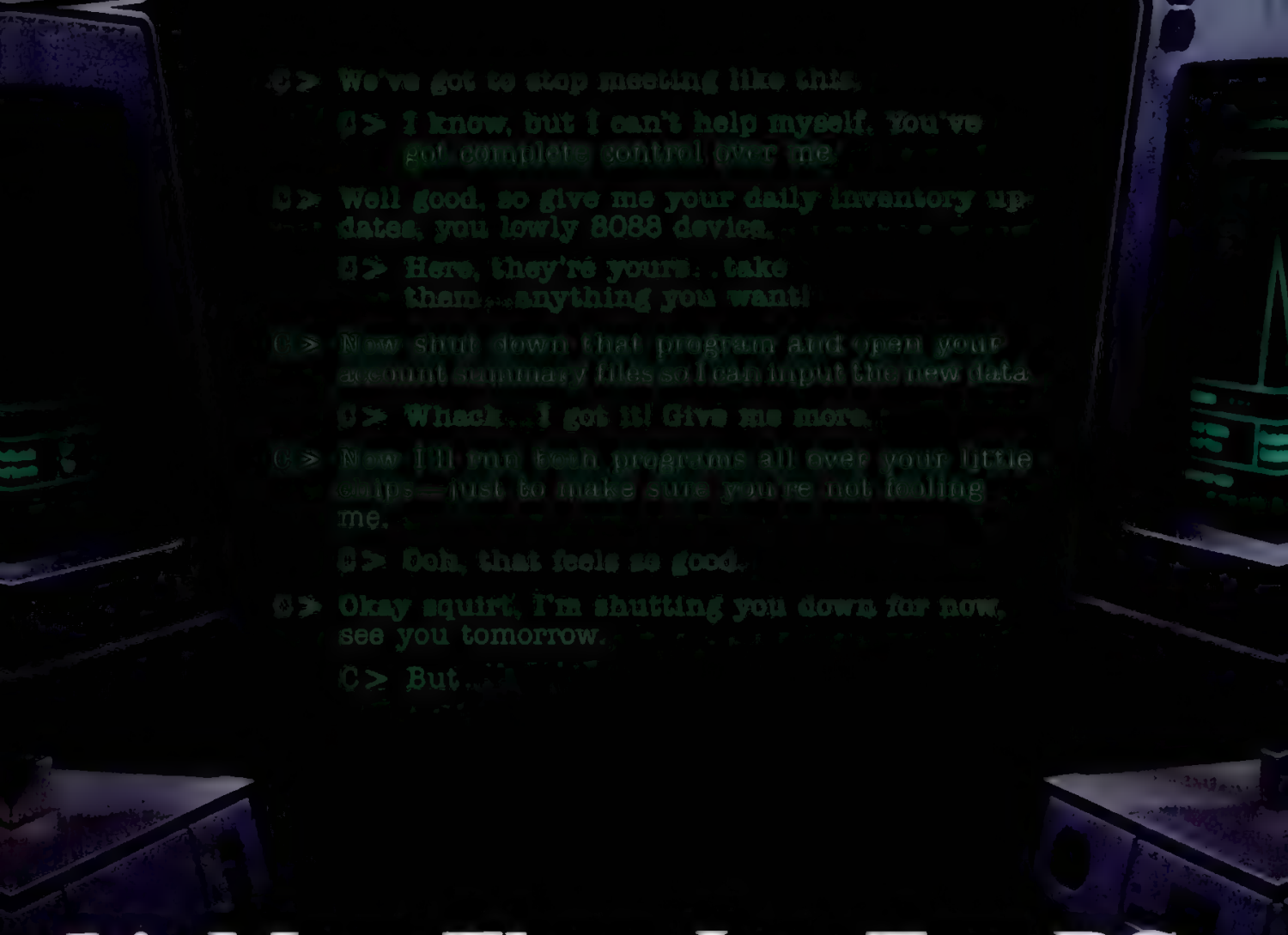
■ *BitCom* features a script language powerful enough to automate most communications tasks.

FACT FILE



***BitCom*, Version 3.5**
BIT Software Inc.
830 Hillview Ct., #160
Milpitas, CA 95035
(408) 263-2197
List Price: $69
Requires: 256K RAM, one disk drive, DOS 2.0 or later.
In Short: Friendly menu format and 50 pages of on-line help make this a good choice for novices. Script language is difficult to master but strong enough to automate most tasks, including remote file transfer. Not copy protected.

CIRCLE 689 ON READER SERVICE CARD



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PC MAGAZINE EDITORS' CHOICE

Software Digest

#1 RATED ADVANCED WORD PROCESSOR, 1988

CIRCLE 518 ON READER SERVICE CARD

Enter key to return to the communications screen. You can select the DOS option and run a program during a communications session, but you cannot do so while transferring a file.

BitCom distinguishes Action files (which are invoked automatically to perform tasks after a connection has been made) from Script files (which control when to call a number, how many times to retry, and what to do if the connection is or is not established). You can use a Script file to make the connection, and an Action file will then be invoked if it is specified in the parameters. These files cannot be created within *BitCom*, which does not have a text editor. Automatic log-on to a host requires an action file to be invoked. If your log-on involves a password, it unfortunately can be seen by anyone who accesses the file from the DOS prompt.

The script language offers more than 80 functions and allows you to nest as many as eight subroutines. While basic communications functions are simplified by the menus, script files allow *BitCom* to be set up for people who don't want to learn a communications program. Prewritten script samples are included for dialing numbers, for receiving and sending files (including selection of protocols), for logging on to an information service (specifically CompuServe), and for automatic answering. These examples cover the major functions of the program, and they are made even easier by the manual, which includes a list of the files on the disk.

The manual does not discuss more-sophisticated applications such as making multiple unattended contacts with file transfers or screening callers for passwords, but it does refer you to the samples for guidance in accomplishing these and similar functions. The script language can handle a wide variety of tasks involving conditional statements, function calls, and responses to your input at prompts. Clever use of the script will expand *BitCom*'s powers substantially, but if you really need these applications, you might want to find a program that includes them.

We found documentation on the script language more suited to the experienced user than to the beginner, and certain key bits of information were not in the manual. Nowhere, for example, could we find which bps rates were available in *BitCom*.

BitCom is not difficult to learn, which makes it very useful to novices and those who need a communications program to execute standard tasks, but its script language may not be rich enough to satisfy more-advanced users.

—John Schoenbeck

.....

Boyan

College student Justin Boyan and his $35 communications program named *Boyan* justify one of our most cherished beliefs: once in a while, out of the blue, a little guy can come up with a good product and make a buck at it. Distributed as shareware, *Boyan* is a top-quality package for the budget-conscious.

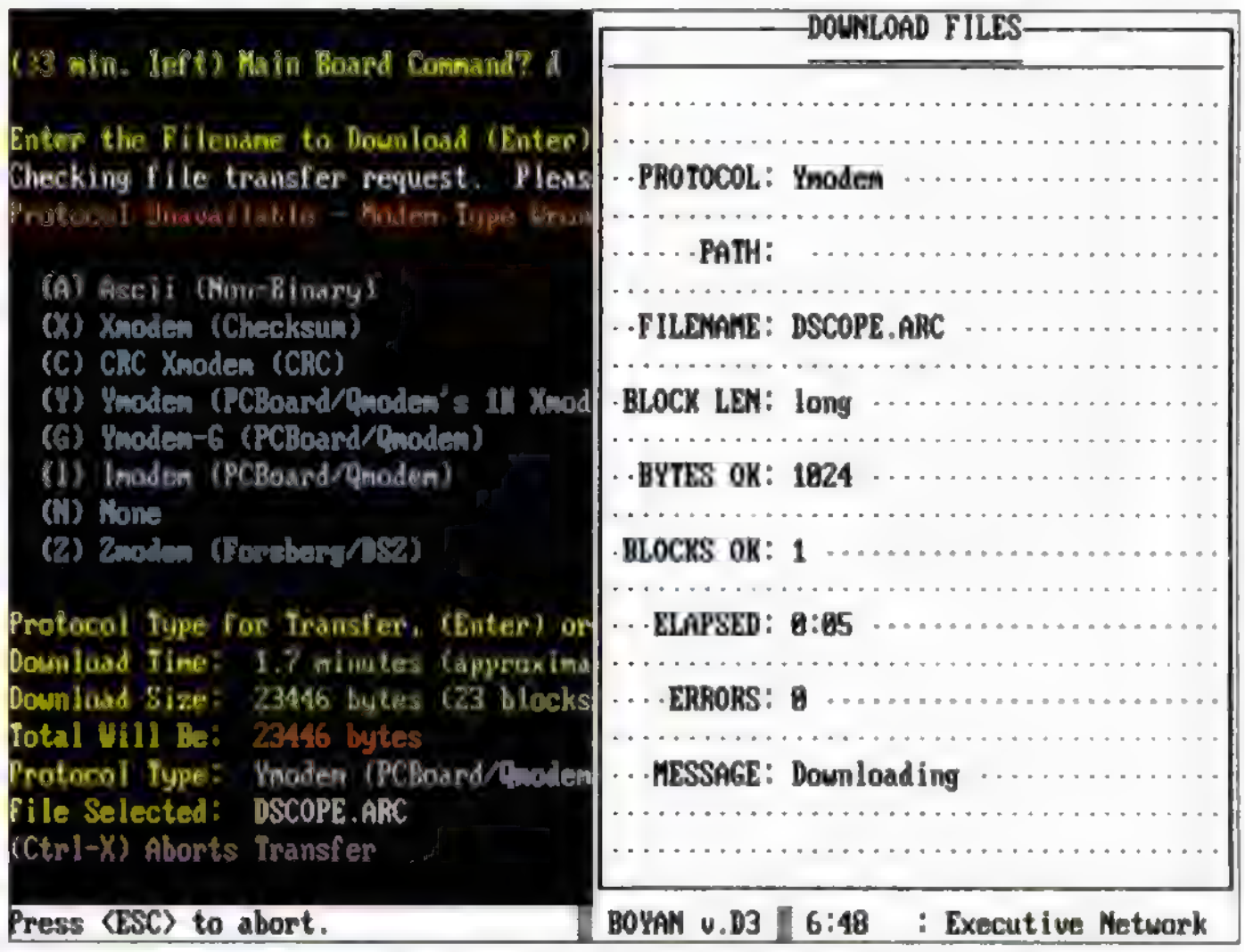
In these days of inflated program size, *Boyan*'s requirements seem minuscule. It can run on a system with only one disk drive. Laptop users will applaud its small appetite.

The program consists of two files: BOYAN-D3.EXE, which "unarchives" itself into all the files you'll need to run *Boyan*, and BOYAN-D3.DOC, the 60-page manual. We had it up and running in less than 20 minutes—without consulting, or even printing out, the manual.

The sign-on screen reminds you that the author is just a starving student and you really ought to send him the measly $35 fee if you haven't done so already. Next, you drop right into terminal mode. As this screen informs you, you can press Ctrl-Home to get one of the 16 context-sensitive help screens.

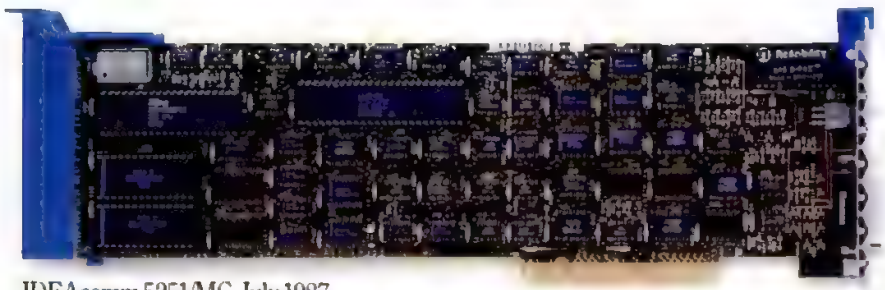
Hitting Alt-C brings up the configuration menu. *Boyan* supports Hayes-compatible modems by default, but you can modify all the command and response strings to match those of practically any other modem. (*Boyan* supports modem speeds only up to 9,600 bits per second and only on COM1 or COM2; if you plan to use that wild new 115,200-bps modem on COM3, you'll have to find another communications program.)

Unlike some programs, *Boyan* automatically sets the character length to 7 bits if you're using even or odd parity, and 8 bits if using no parity. These combinations are the most common, but we'd prefer to have the option of setting the two parameters separately.

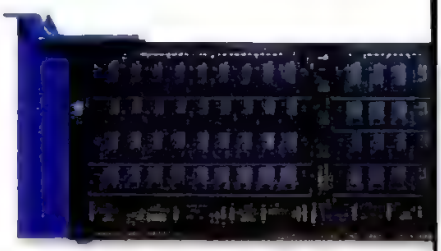


After you hit PgDn for a file download, Boyan *scans the screen buffer for the name of the file you're downloading to save you from typing it twice. On the left of the screen are the protocols the program supports.*

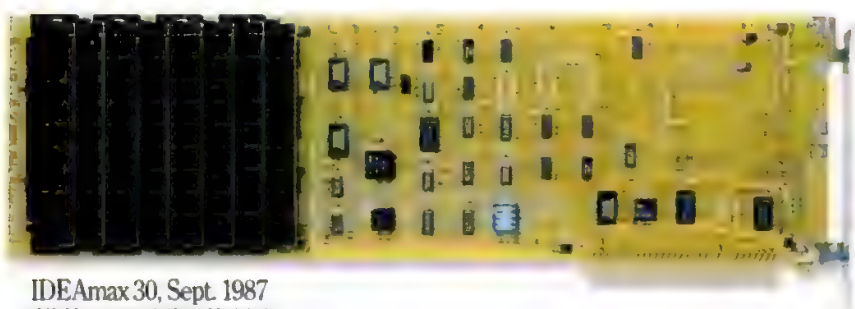
Every time IBM giv we're the first



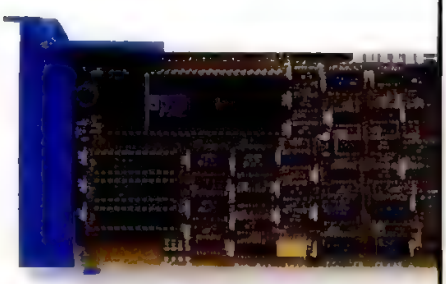
IDEAcomm 5251/MC, July 1987
Local 3X Communications for the IBM PS/2



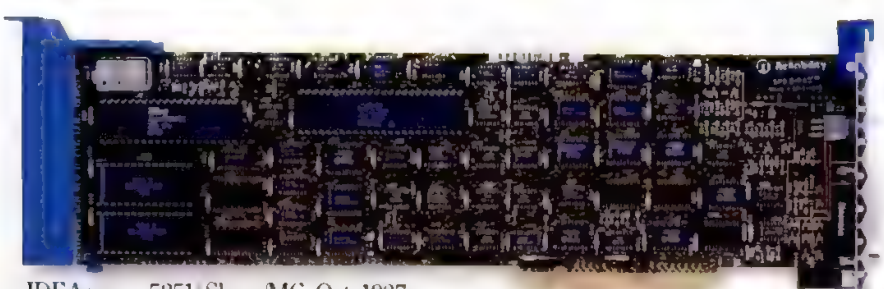
IDEAmax/MC, Oct. 1987
12MB Memory for the IBM PS/2



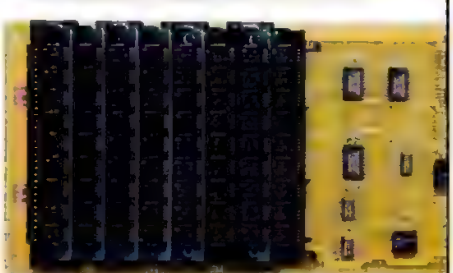
IDEAmax 30, Sept. 1987
8MB Memory for the PS/2 Model 30



IDEAcomm 3278/DFT/MC, Nov. 1987
Local Mainframe Communications for the IBM PS/2



IDEAcomm 5251/ Share/MC, Oct. 1987
PS/2 Gateway Communications to the IBM System 3X



IDEA Supermax 30, Nov. 1987
8MB and Ports for the PS/2 Model 30

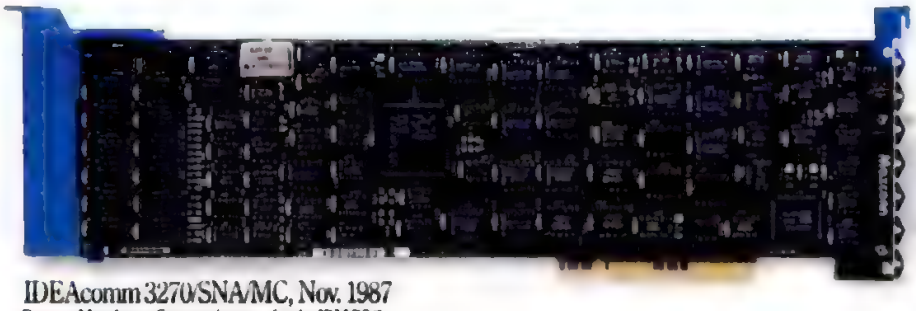
On April 2, 1987, IBM brought the world to a standstill when it brought the PS/2 to life.

Now while everyone else waited to see how this latest offspring would be accepted, we quietly set out to create products that would help the PS/2 reach its fullest potential. And two months later, we delivered.

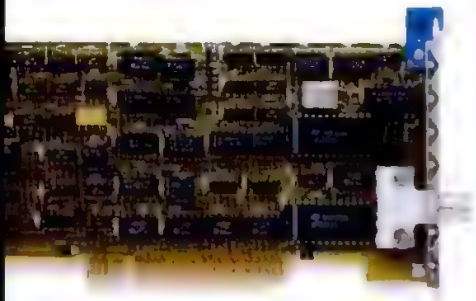
In fact, we were the first to devise completely functional local and remote links between the PS/2 and System 3X minicomputers. First to offer local and remote gateway communications for the PS/2 on a local area network. And first with a Micro Channel® board that adds up to 12 megabytes of memory.

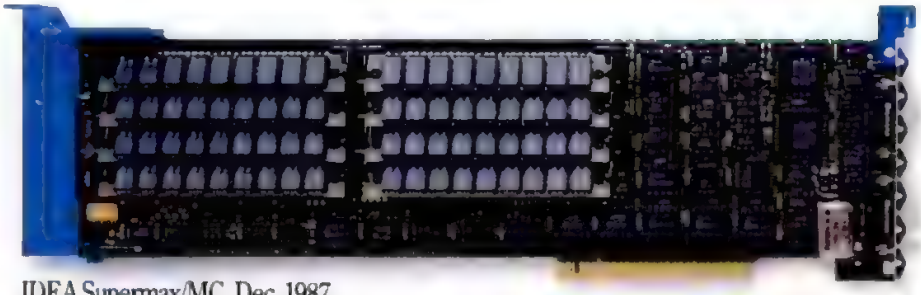
Our list of firsts didn't start with the PS/2, either. For example, we pioneered the industry standard in backplane design for multifunction boards. And we were the first to fully apply surface mount technology, which allowed us to put all the basic computing functions onto one PC board. (Interestingly enough, a year later IBM

es birth to a new PC, to send out cards.

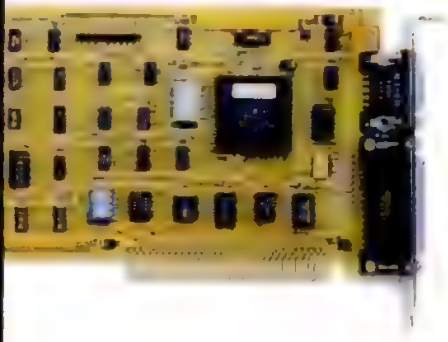


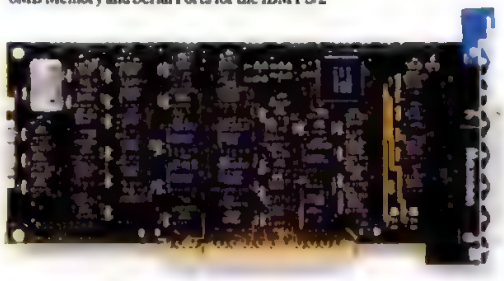
IDEAcomm 3270/SNA/MC, Nov. 1987
Remote Mainframe Communications for the IBM PS/2



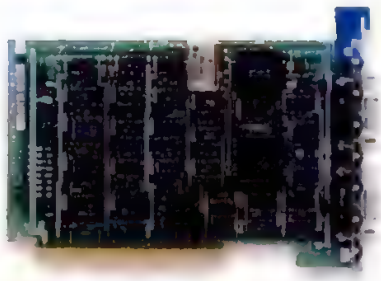


IDEA Supermax/MC, Dec. 1987
8MB Memory and Serial Ports for the IBM PS/2





IDEAcomm 5250/Remote Gateway/MC, Dec. 1987
PS/2 Remote Gateway to the IBM System 3X



IDEAmini/MC, May 1988
I/O Card for the IBM PS/2

used surface mount technology to create the PS/2.)

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CIRCLE 265 ON READER SERVICE CARD

Most *Boyan* commands are easy-to-remember mnemonic Alt-key combinations, like Alt-D to dial and Alt-H to hang up. In fact, *Boyan*'s user interface was strongly influenced by the *PC-Talk/Qmodem/ProComm* school of communications program design; users familiar with those programs should have little trouble with *Boyan*.

You make some trade-offs when you buy software for $35. With *Boyan*, the trade-off is support; there's no staff to answer calls. Boyan himself and other users polled over a bulletin board will be your primary support. Of course, *Boyan*'s ease of use mitigates this trade-off.

DIALING The dialing directory holds up to 200 phone numbers, each of which can call a script file to automate the log-in process. While you can sort the directory according to name, you have to specify the number (1 to 200) for the computer you want to call. As you might expect from shareware, *Boyan* includes predefined log-in scripts for RBBS, PC-Board, and other BBS systems but not for commercial services like CompuServe and MCI Mail.

If a number *Boyan* dials is busy, *Boyan* throws it on the redial queue. If you regularly check in to several services, you could log in to the available ones, with the busy numbers on the queue waiting to be redialed. When you activate redialing, *Boyan* calls each number on the queue in turn until it has made all the connections. When it makes a connection, *Boyan* beeps loudly to call you back to the computer.

NEAT TRICK To download a file, you just press PgDn. Since *Boyan* scans the screen buffer for the name of the file you're downloading, you don't have to reenter the filename—a neat little trick that other programs should adopt.

Boyan supports the Xmodem, Xmodem-CRC with fallback, Ymodem (Xmodem-1K), and Ymodem-G (streaming Xmodem-1K) protocols. It can also use external protocol programs, like DSZ for Zmodem or PC-Kermit for *Kermit*, to upload and download files using those protocols. *Boyan* was one of the better performers on the PC Labs performance tests for Xmodem transfers.

Boyan has powerful script and macro languages. Most of what other communications programs store as simple strings *Boyan* stores as a macro. This feature enables you to build fancy macros to accommodate unusual modems and phone systems. The more than 100 macro commands enable you to do almost anything you can do from the keyboard.

To *Boyan* a macro is a one-line program, and a script is just a file of macros strung together. Scripts can include branches to labels. Macros are recursive. Unlike *Crosstalk Mk.4*'s CASL and *Smartcom III*'s Scope, *Boyan*'s terse script language lacks support for general-purpose programming, but it handles basic communications tasks easily and well.

Boyan's "scrollback buffer" makes your on-line life easier by saving data that scrolls off the top of the screen. Other nifty *Boyan* features include its DOS file manager and its Gossip mode, which divides the screen into separate windows for incoming and outgoing data, making it easier to hold a "conversation" on-line. And *Boyan*'s wonderful "backspace editor" steals from the screen buffer the line you were typing on-line and lets you edit it.

But *Boyan* is not perfect. It doesn't support multiple sessions, terminal emulation, or remote operation. The generally good manual, while including both an index and table of contents, could use additional and more-complex examples of scripts, and a better explanation of the script language.

Still, *Boyan* is pretty impressive. Yes, it has more than a passing resemblance to Datastorm's *ProComm* shareware program, which has features, such as terminal emulation, that *Boyan* lacks. But *Boyan* is easy on you as well as your budget, and in the tough world of communications, that kind of comfort counts.—**Howard Marks**

PC MAGAZINE FACT FILE

***Boyan*, Version D3**
Boyan Communications
9458 Two Hills Ct.
Columbia, MD 21045
(919) 682-4225 (BBS)
List Price: $35
Requires: 256K RAM, DOS 2.1 or later.
In Short: A shareware product similar to *ProComm* with surprisingly powerful script and macro languages. Does not support remote operation or multiple sessions, however. Not copy protected

CIRCLE **680** ON READER SERVICE CARD

Crosstalk Mk.4

Crosstalk Mk4 is the powerful successor to *Crosstalk XVI*, but the relationship between the two does not extend far beyond their names. Priced at $245, DCA/Crosstalk Communications' *Crosstalk Mk4* is targeted at sophisticated communications users who require multiple communications sessions using combinations of modems, direct connections, and other devices. Its programming language, CASL (Crosstalk Application Script Language), also makes *Crosstalk Mk4* appealing to power users.

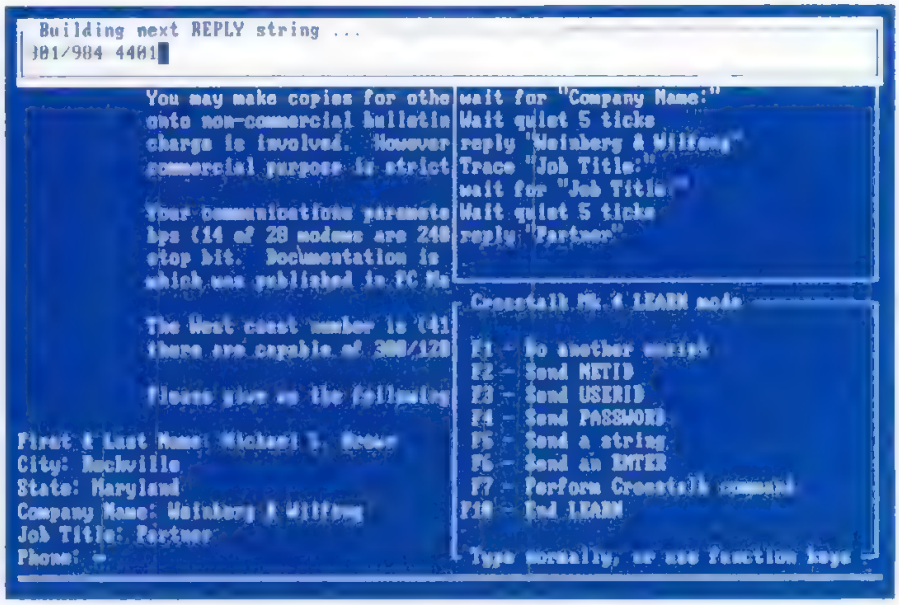
Crosstalk Mk4's user interface and clean, uncluttered screen are vastly different from what you'll find in *Crosstalk XVI*. If the communications parameters require some alteration, you can call them up through menus or by using an Alt-key combination.

Crosstalk Mk4 comes on two disks. Its manual leaves a bit to be desired. Installation instructions say to place the disk marked Crosstalk Program Disk in drive

PC MAGAZINE FACT FILE

***Crosstalk Mk.4*, Version 1.01**
Digital Communications Associates Inc.
Crosstalk Communications Division
1000 Holcomb Woods Pkwy.
Roswell, GA 30076
(800) 241-6393
(404) 998-3998
List Price: $245
Requires: 256K RAM, DOS 2.0 or later.
In Short: A high-powered program that has excellent file-transfer protocols and a powerful programming language. Allows up to 15 concurrent communications sessions. Not copy protected.

CIRCLE **679** ON READER SERVICE CARD



Although Crosstalk Mk.4 *is targeted for users who require multiple communications sessions using combinations of devices, the program includes an easy-to-use learn mode that enables creation of scripts for often-used communications services.*

A:, but neither disk is so marked, and menus are identified by inexact names. Support is not toll-free, and the number is often busy, but the technical service is excellent once you reach it. On-line help is available, but not when you are running a script file.

■ *Crosstalk Mk.4*'s power becomes evident when using the X.PC modem driver, which can handle up to 15 communications sessions on a single modem.

Crosstalk Mk4 contains 29 prewritten scripts and includes an easy-to-use learn mode, which you invoke by typing Do Learn at the command line. *Crosstalk Mk.4* builds the script file, and you can edit other enhancements into it or even write a script to invoke one of the prewritten scripts.

DAZZLING DISPLAYS The CASL script language borrows from Pascal and BASIC. Scripts can reference line numbers or labels and use English-like commands and statements. The scripts you create with CASL can handle multiple communications sessions and dazzling screen displays that include such features as painted windows.

Crosstalk Mk4's power becomes evident when using the X.PC modem driver, which can handle up to 15 communications sessions on a single modem. You can even create a rudimentary BBS. But once compiled, *Crosstalk Mk4* does not allow a script to be decompiled. If *Crosstalk Mk4* encounters a compiled script with a date and time earlier than a source script, it assumes changes have been made and will recompile the script. If an error is encountered during the compilation, *Crosstalk Mk4* describes the error; gives you the name of the script, the line number, and the actual line; and lets you edit the line before continuing compilation.

Crosstalk Mk4's DART file-transfer

We have one thing to say to the people who keep getting personal about PROCOMM PLUS.

"Right now, PROCOMM PLUS is the definitive telecom program and the one I personally use and recommend."

John C. Dvorak, columnist, PC Magazine

People who review software have a very tough job. They see hundreds of new programs every week. But the ones who have seen the new PROCOMM PLUS communications software are doing more than writing rave reviews about it. They're getting personal. They're using it at work and at home.

Maybe it's because PROCOMM PLUS is so easy to use it's "intuitive." Or perhaps it's because PROCOMM PLUS has an extremely powerful script command language, context sensitive help, 16 terminal emulations with keyboard re-mapping, 12 file transfer protocols, a fully-automated dialing directory, and advanced host mode with electronic mail.

But one thing is for certain. If PROCOMM PLUS is the personal choice of the people who review software, you can be sure that PROCOMM PLUS is right for you.

It's time you got personal about PROCOMM PLUS. Ask for PROCOMM PLUS at a dealer near you. Or, call 314-474-8461.

Thank You.

CIRCLE 504 ON READER SERVICE CARD

Communications Software: Summary of Features

(Products listed in ascending price order)

	Boyan $35.00	Ptel $49.00	ProComm $50.00	Qmodem $50.00	BitCom $69.00	Mirror II $69.95	ProComm Plus $75.00	MEX-PC $99.95	SideTalk $119.95
PROGRAM DESIGN									
Command strategy	Alt-key combinations	Command line	Alt/Ctrl-key combinations	Alt-key combinations, command line, menus	Menus	Command line	Alt/Ctrl-key combinations, *Lotus 1-2-3*–style menus	Alt-key combinations, command line, function keys, menus, point-and-shoot commands	Alt-key combinations, command line, function keys, menus, point-and-shoot commands
DOS functions included	●	●	●	●	○	●	●	●	●
Exits to DOS on local machine without breaking communications	●	●	●	●	●	●	●	●	● (in background only)
Built-in text editor	○	○	○	○	○	●	●	○	○
On-line help	●	●	●	●	●	●	●	●	●
MODEM SUPPORT									
Transmission-rate settings (bps)	300–9,600	300–9,600	300–19,200	300–38,400	110–19,200	50–115,200	300–115,200	110–115,200	110–57,600
Standard AT command set	●	●	●	●	●	●	●	●	●
Hayes extended command set	●	●	○	●	●	●	●	○	○
Other	User-definable	None	User-definable	None	None	PC*r*, Racal-Vadic, user-definable	User-definable	Racal-Vadic	None
REMOTE OPERATIONS CAPABILITIES									
Remote operations via the communications software	○	●	●	●	●	●	●	●	●
Access to DOS level on host machine	○	○	●	●	○	○	●	●	●
Runs programs remotely	○	○	●	●	○	○	●	●	●
Remote file transfer	○	●	●	●	●	●	●	●	●
Password protection for remote file transfer	○	○	●	●	●	●	●	●	●
ADDITIONAL FEATURES									
Single password	○	○	●	●	●	●	○	●	○
Different passwords for different users	○	○	○	○	●	●	●	○	●
Background file transfer	○	○	○	○	○	●	● (with *Windows*, *DESQview*, or *TopView*)	○	●
Simultaneous two-way transfer	○	○	○	○	○	○	○	○	○
Max. no. of retry settings	Unlimited	Unlimited	10	N/A	Unlimited	Defined by protocol	15	Defined by protocol	N/A
Memory-resident mode	○	○	○	○	○	○	○	○	●
Macros	○	○	○	●	●	●	●	●	●
Script-language learn mode	○	○	○	○	○	●	●	○	○
User-defined menus	○	○	●	●	○	○	●	●	●
No. of terminal emulation modes	1	2	8	4	2	11	16	10	Unlimited (customizable)

—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable this feature is not available

Respond/ Async $129.00	Professional-YAM $139.00	Freeway Advanced $139.95	HyperAccess $149.00	Relay Silver $150.00	Ascom IV $195.00	Crosstalk XVI $195.00	Lync $195.00	Seiterm $195.00	Crosstalk Mk.4 $245.00	Smartcom III $249.00	Relay Gold $250.00
Menus	Command line, Ctrl-key combinations, function keys	Command line, menus, point-and-shoot commands	Function keys, menus	Alt/Ctrl-key combinations, function keys, menus, point-and-shoot commands	Command line, function keys, menus	Command line, function keys, menus	Command line	Alt-key combinations, menus	Alt-key combinations, command line, function keys, menus	Menus	Alt/Ctrl-key combinations, function keys, menus, point-and-shoot commands
○	●	○	●	●	●	●	●	●	●	●	●
●	●	●	●	●	○	●	○	●	●	●	●
●	●	●	○	●	●	○	○	●	●	●	●
●	●	●	○	●	●	●	●	○	●	●	●
100–19,200	50–57,600	75–115,200	50–57,600	50–19,200	50–19,200	75–115,200	300–9,600	50–19,200	Modem-dependent	100–115,200	50–19,200
●	●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●	●
None	Trailblazer, Fastcomm	User-definable	IBM PC Convertible, Trailblazer, Microcom, CDS, Multitech, supported MNP modems	AT&T, EVA UPTA-96, Penril, Racal-Vadic, Rixon, Trailblazer, Telenetics, user-definable	None	User-definable	None	AT&T, UDS, and 28 others	AT&T, Bizcomp, CDS, DCA, Racal-Vadic, Rixon, user-definable	None	AT&T, EVA UPTA-96, Penril, Racal-Vadic, Rixon, Trailblazer, Telenetics, user-definable
●	●	○	●	●	●	●	●	○	●	●	●
●	●	○	●	●	○	○	●	○	●	●	●
●	●	○	●	○	○	○	●	○	○	○	○
●	●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●	●
○	●	○	●	●	●	●	○	●	○	●	●
○	○	○	○	●	○	○	○	●	○	●	●
○	○	○	○	●	○	○	○	●	○	●	●
10	Defined by protocol	1	Defined by protocol	65,535	65,535	10	N/A	255	N/A	1,000	65,535
○	○	○	●	●	○	○	●	●	○	●	●
●	●	●	●	●	●	●	○	●	●	●	●
○	●	●	●	●	○	○	○	●	●	●	●
●	●	○	●	●	●	○	○	●	●	●	●
4	11	3	10	5	8	9	None	44	18	3	6

Communications Software: File-Transfer Protocols

(Products listed in alphabetical order)

	Ascom IV	BitCom	Boyan	Crosstalk XVI	Crosstalk Mk.4	Freeway Advanced	HyperAccess ▲	Lynx	MEX-PC	Mirror II	ProComm ▲	ProComm Plus ▲	Professional-YAM	Pro!	Omodem	Relay Gold
CompuServe-A	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
CompuServe-B	○	○	○	○	●	●	○	○	○	○	●	●	○	○	○	○
CompuServe Quick-B	○	○	○	○	●	○	○	○	○	○	○	●	●	○	○	○
Crosstalk	○	○	○	●	●	○	○	○	○	●	○	○	○	○	○	○
Hayes	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○
Imodem	○	○	○	○	○	○	○	○	○	○	○	●	○	○	●	○
Kermit	○	●	●	●	●	●	●	○	●	●	●	●	●	●	●	●
Megalink	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Modem7 batch	○	○	○	○	○	○	○	○	●	●	●	●	●*	●	○	○
Proprietary	●	○	○	○	●	●	●	●	○	○	○	○	○	○	○	●
Relaxed Xmodem	○	○	●	○	○	○	○	○	○	○	○	○	○	○	●	○
Sealink	○	○	●	○	○	○	○	○	○	○	○	●	●	○	○	○
Streaming Xmodem 1K	○	○	●	○	○	○	○	○	○	○	○	●	○	○	○	○
Telink	○	○	○	○	○	○	○	○	○	○	●	●	●*	●	○	○
WXmodem	○	○	○	○	○	○	○	○	○	○	●	●	●	○	●	○
Xmodem (checksum)	●	●	●	●	●	○	○	●	●	●	○	○	○	●	●	●
Xmodem 1K	●	●	●	○	●	●	○	○	●	○	●	●	●	○	●	○
Xmodem-CRC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●
Xmodem-CRC with fallback	●	●	●	○	●	●	●	○	●	●	●	●	●	●	●	○
Xmodem OverThruster	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○	○
X.PC	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○
Ymodem batch	●	●	○	○	●	●	○	○	●	●	●	●	●*	○	●	○
Ymodem-G	○	○	○	○	●	○	○	○	○	●	○	●	●	○	●	○
Zmodem	○	○	●	○	○	○	○	○	○	○	○	○	●**	○	●	○

▲ —Indicates Editor's Choice ●—Yes ○—No

*Professional-YAM offers three versions of each of these protocols.

**Professional-YAM offers five versions of this protocol.

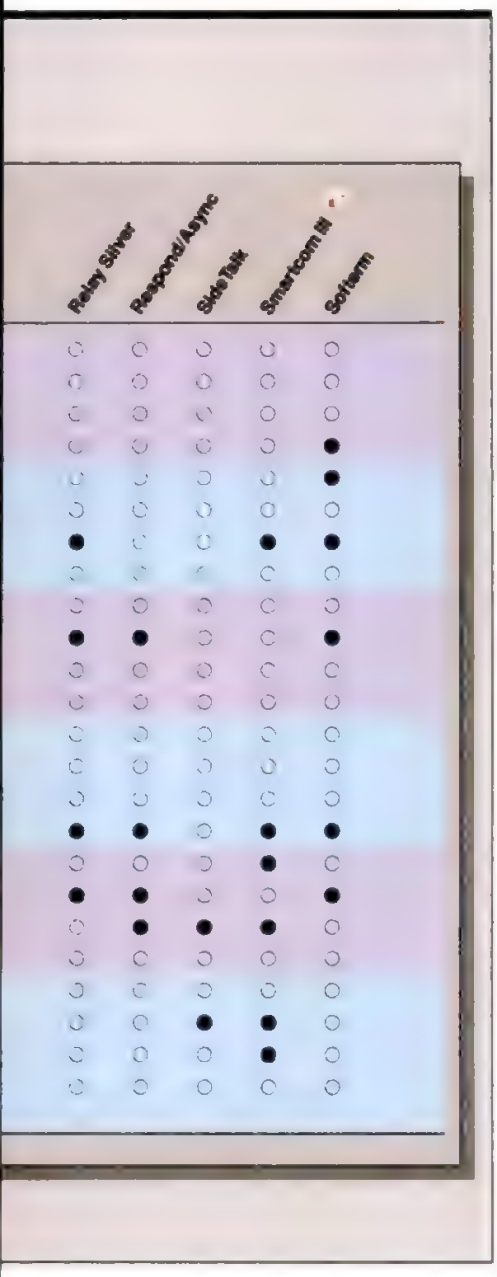
protocol comes in handy if the communications link is disconnected during a file transfer. If you later connect and redo the transfer, DART picks up where it left off. This is especially beneficial when transferring very large files.

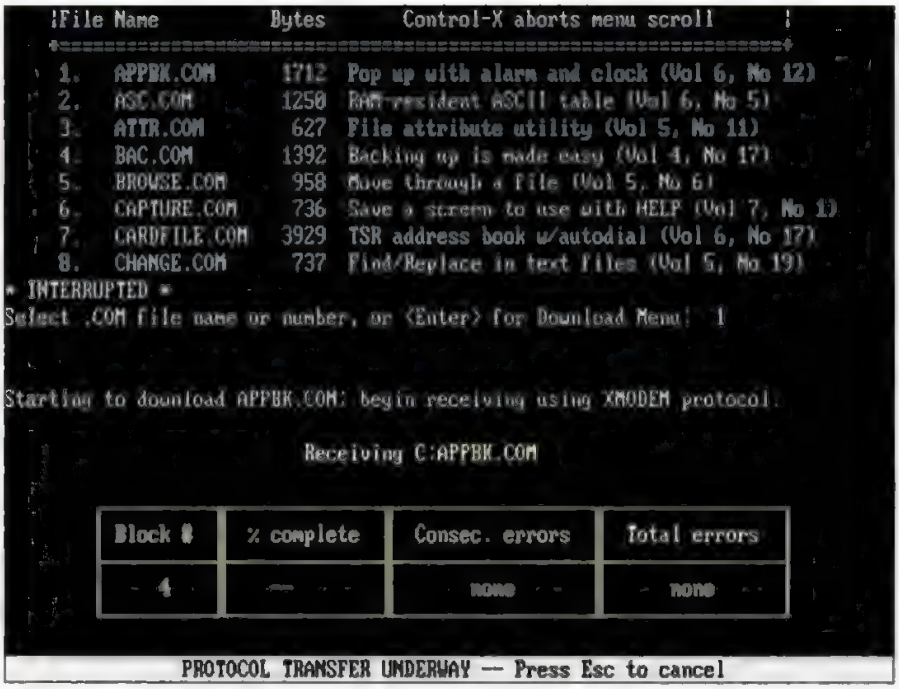
Crosstalk Mk.4 is a powerful but challenging program. If you want CASL and plan to transfer large files, it is a very attractive program. But if ease of use is a concern, you might want to investigate other packages.—**Michael Brown**

Crosstalk XVI

Although *Crosstalk XVI* hasn't been updated in over a year, it is certainly not an orphan program. It is still being actively marketed by DCA/Crosstalk Communications, and there is no hint that support for the $195 package will wane. However, with the birth of the new, improved *Crosstalk Mk.4*, *Crosstalk XVI* may find itself quickly assuming the status of an unwanted stepchild.

Crosstalk XVI has always had an interesting place in the communications market. Users who want to get a taste of programming usually find *Crosstalk XVI*, with its straightforward script language, a good place to start. And if you'd rather not deal with a programming language, the product will shield you from what is going on behind the scenes. But those who use more-sophisticated applications that demand a complex language structure will want to look elsewhere.





Crosstalk XVI *constantly displays the status of a file being downloaded using the Xmodem protocol, along with any transmission errors that may occur. The Esc key is always used either to stop a process or to toggle to and from the command line.*

SCRIPTED OPERATIONS *Crosstalk XVI* operates through a series of scripted operations that are accessed through two file types: command files, which have the suffix .XTK, and script files, which end in .XTS. The former contain all the parameters necessary for making a call, such as the phone number and bit-per-second rate. More-complex operations are governed by the script file, which is invoked automatically whenever a command file of the same name is used.

The first time *Crosstalk XVI* is called up, it automatically runs through a script that takes care of default system parameters. Users of such well-known systems as The Source and MCI Mail can also add phone numbers and passwords through an automated sequence that drops the appropriate phone numbers and passwords into their proper places in the script files.

These files, and all other *Crosstalk* functions, are called up from the main status screen. Most features that may need to be changed by the user, such as the phone number, bps rate, and so on, are in view here, along with their current status. Commands are typed in at the bottom of the screen, using either the first two letters of the word or the entire word itself; and you will be prompted by the program if you have not fully completed the command. For example, NU 1-212-555-1212 will change the number to be dialed; if you simply type NU or NUMBER on the command line, the program will ask you for the number you wish to dial.

Once you make a call, you are automatically placed in the terminal screen, where all on-line communications take place. The Esc and Home keys toggle back and forth to the command line and the status screen, respectively.

For anything more sophisticated than a

FACT FILE

***Crosstalk XVI*, Version 3.61**
Digital Communications Associates Inc.
Crosstalk Communications Division
1000 Holcomb Woods Pkwy.
Roswell, GA 30076
(800) 241-6393
(404) 998-3998
List Price: $195
Requires: 128K RAM, DOS 2.0 or later
In Short: This old favorite has a flexible script language and is also relatively easy for newcomers to handle; however, it is not suitable for more-sophisticated applications. Not copy protected.

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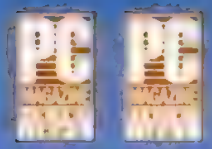

PC Magazine's Editor's Choice Award
Communications Software, October, 1986
Background Communications Software,
May, 1987.

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simple sign-on, *Crosstalk XVI*'s language is useful. It is flexible enough to supply many of the options needed for simple business use, including the ability to wait for and reply to on-line prompts, to wait for a specified time and then run the script, to accept and process keyboard information, and to conditionally jump to other parts of the script.

SCRIPT TRICKS Novice programmers will find that there are advantages to dealing with a program that has been around as long as *Crosstalk XVI*. Because of its popularity, there are quite a few script tricks (unfortunately not mentioned in the manual) circulating around the user network. For example, *Crosstalk XVI* by itself has no function to allow you to operate your computer remotely outside of a few simple communications features. (In fact, the XDOS command, which exits the program, can be accessed when you are talking remotely with the computer—with the result that you place your remote computer in DOS and out of contact.) However, you can persuade the program to do so using a short batch file, which was recommended to me by a *Crosstalk* technician (for more information, see Power User, *PC Magazine*, October 27, 1987).

It would have been helpful if DCA had included some of these tips in the manual, which, like the program, has not been updated for some time. However, the technical support staff at DCA is knowledgeable and helpful; in addition, there is now a *Crosstalk* SIG on CompuServe that users who have questions can access.

Unfortunately, *Crosstalk XVI*'s own help facilities leave something to be desired. There is a Help function that lists the commands available; for more information, you type Help and the command you are inquiring about. But if you are uncertain about which command will, say, let you upload using Xmodem, you will have to do a great deal of guessing.

You will find many users who still swear by *Crosstalk XVI*, and if you're looking to purchase a communications program for the first time—or if you've got a friend who's accumulated a lot of *Crosstalk* scripts—and don't need anything particularly exotic, you may want to give this one a glance. But be warned. When I pressed DCA's technical staffers on questions about a couple of PC Labs' more-elaborate applications tests, their reply went something like this: "Well, we probably could figure something out eventually, but we'd really have to put the program through loops to get it. I'm sure that *Crosstalk Mk.4* does it, though . . . ."

—Barbara Krasnoff

Freeway Advanced

Freeway Advanced, from Kortek, brings fully functional communications to the novice. To the power user it offers a *Crosstalk*-compatible script language, a keystroke learn feature, terminal emulation (VT-100, VT-52, TTY), and support for several protocols. But somewhere in between things bog down. If you're a beginner who wants to work up to power user status, you may not find all the tools you'll need in this $139.95 package.

Getting up and running is easy. The documentation is well organized, if at times sketchy. Nevertheless, those who want to skip the basics will appreciate a section called "Three Test Drives," in which the most important parts of the program are discussed. Novices will find a useful section called "Everything You Ever Wanted to Know About Computer Communication, but Were Afraid to Ask." There are also sections on troubleshooting that outline the difficulties you might encounter and corrective actions that you can take when you do.

POINT-AND-SHOOT APPROACH *Freeway Advanced*'s menus are easy to follow and use. They employ a point-and-shoot approach that keeps keystrokes to a minimum and helps a novice stay on track. Context-sensitive help is also available. You simply type "?" to call up a clarification of a function. There is also a handy autopilot feature that "learns" steps in functions that are performed often.

Passwords can be set for a phonebook entry and its accompanying autopilot, as well as for remote access to your system. Remote-access passwords are encrypted and hidden in one of the system files.

Freeway Advanced can work at speeds up to 115,200 bits per second, and modem parameters can be set and changed at any time. The program supports the following protocols: Xmodem, Xmodem 1K, Ymodem batch, Kermit, and Crosstalk.

Freeway Advanced's *point-and-shoot menu-driven structure lets you see exactly where you are. In the above screen, the user is editing a phonebook entry.*

Freeway Advanced organizes phone numbers into nine phonebooks with 12 entries each. With each entry you can specify bps rate, parity, terminal type, and data format. You place a call by simply dialing automatically from the phonebook. You can set the number of times the system will redial, as well as the time intervals between the redials.

The chapters in *Freeway Advanced*'s manual are brief, and many features are either not covered completely or not covered at all. Complicating the situation is the fact that changes were made to the program after the documentation was published. Help is available from a Read Me file on the floppy disk, but it is a nuisance to abandon your project and repeatedly consult this file for basic information.

Freeway Advanced's greatest shortcoming, however, is its script language. The commands are listed alphabetically in the documentation, which is fine, but they are not accompanied by examples so that you can see what a script looks like. Customer support suggests that you look at the bulletin board script that is on the program disk. This is helpful to an experienced user but it does not offer much to the novice. The script language is *Crosstalk*-compatible, but few users will want to purchase *Crosstalk* to get a manual that explains how to use the script language.

—Patricia L. Becker

HyperAccess

Hilgraeve's $149 *HyperAccess* (IBM PC Revision 3.25) has developed into one of the finest communications packages on the market. It features high-speed file transfer, a powerful script language, an easy-to-use interface, and an interactive tutorial.

Novice users can get off to a good start by using the informative tutorial and proceeding step by step or by jumping to the chapter of their choice. Extensive sample communications sessions demonstrate every aspect of the program—from making manual data calls to using the most complicated auto-log-on scripts.

For hard disk users, installation is as easy as typing COPY. The first time you run *HyperAccess*, it automatically executes a start-up script, written in its HyperPilot script language. The program prompts you for the necessary installation parameters, then modifies your CONFIG.SYS (harmlessly) and installs a device driver.

HyperAccess is compatible with TSRs like *SideKick* and multitasking programs like *DESQview*, *TopView*, *DoubleDOS*, and *Microsoft Windows*. It includes all the drivers and instructions you need to run these programs along with it.

FOLLOWING PROTOCOL *HyperAccess* performed the fastest Xmodem file transfer on PC Labs performance tests—even with its proprietary data compression scheme turned off. Its proprietary protocol, HyperProtocol, is significantly faster than most common protocols because of its streaming data flow and data compression features. HyperProtocol is a must for those who transfer files through noisy phone lines.

Without exiting from *HyperAccess*, you can execute DOS commands and other programs. Therefore, you can easily examine or manipulate files in your computer or run another program without breaking a communications link. When executing memory-hungry programs, you can save *HyperAccess* to disk to free up valuable amounts of RAM.

HyperAccess's remote-operations feature permits an authorized user to control his computer through the keyboard of a remote terminal. The host defines users' individual passwords and levels of access, and users with limited access cannot over-

Pressing F1 on HyperAccess*'s main menu invokes the program's Call screen, which displays the first eight entries in the phone list. The Hayes Smartmodem 2400 displayed in the upper right is only one of more than three dozen models chosen during the installation routine.*

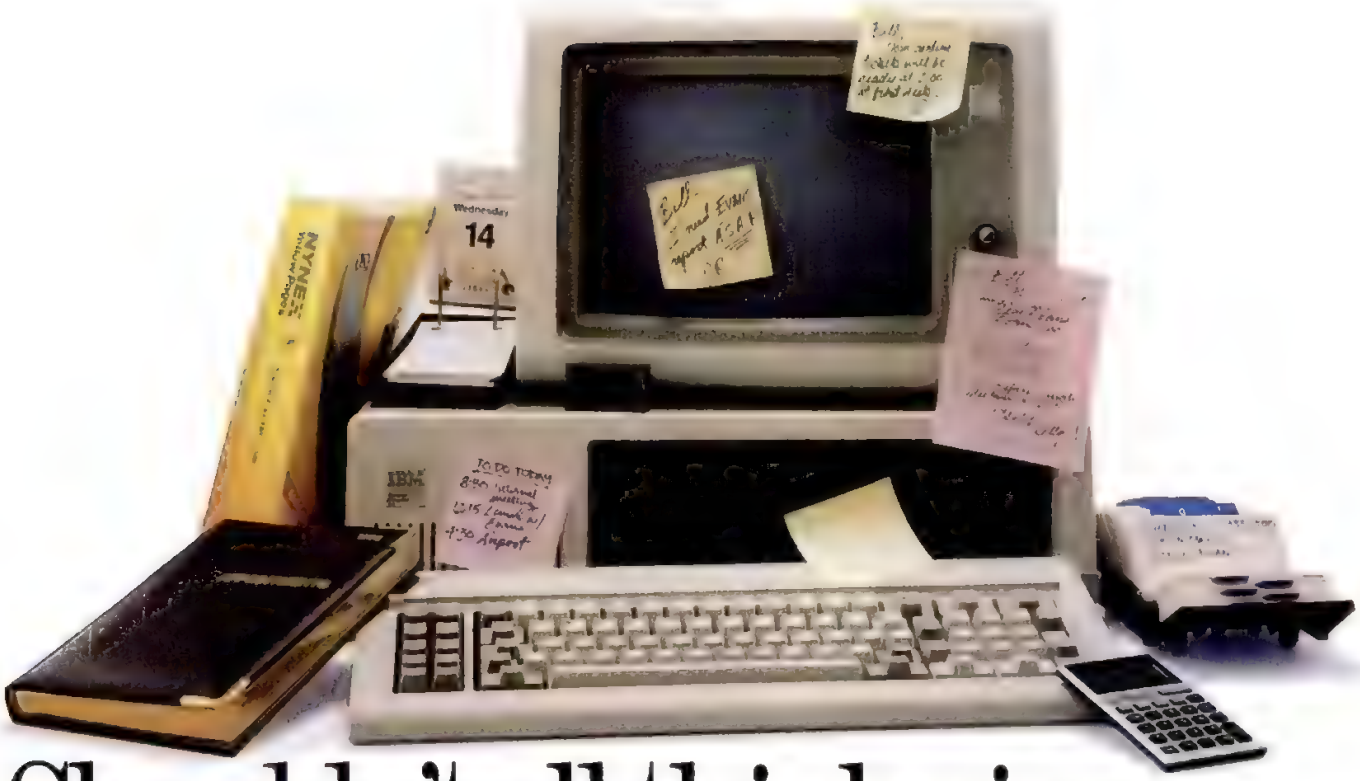
FACT FILE

***Freeway Advanced*, Version 2.2**
Kortek Inc.
505 Hamilton Ave.
Palo Alto, CA 94301
(800) 327-0310
(415) 327-4555
List Price: $139.95

Requires: 384K RAM (640K recommended), one disk drive (hard disk recommended), DOS 2.0 or later.

In Short: An easy-to-follow menu-driven system makes this program good for beginners. Its script language is *Crosstalk* compatible, but documentation on its use is sketchy and of little value to those wanting to learn it. Not copy protected

CIRCLE 688 ON READER SERVICE CARD



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*Suggested Retail Price

write or delete files on the host computer.

With *HyperAccess*, you can automate entire communications processes. *HyperAccess* can sign on to remote systems and handle routine file transfers or place calls for you in the middle of the night. To automate a process with HyperPilot, you can write a script using your favorite text editor and then have *HyperAccess* automatically compile it.

You can execute scripts with remarkable flexibility. You can run scripts directly from the DOS command line or run them from the communications screen. Finally, you can designate a script as a "sign-on" script, which the program automatically executes after a communications link has been established.

To get you started, included with *HyperAccess* are 36 useful, prewritten scripts, including log-on scripts to many popular remote systems. Other scripts place a data call at a designated time, log in to and download files from a *HyperAccess* host, and set up your system as a high-security dial-back host. What's more, *HyperAccess* can run the scripts unattended. When the program first runs an auto-log-on script, it learns your sign-on password and stores it for use in future auto-log-ons. Unfortunately, since .NIX files are unencrypted, anyone can, with the aid of a few simple DOS commands, view your passwords and thereby compromise the security of your communications.

EDITOR'S CHOICE

FACT FILE

***HyperAccess*, Version 3.25**
Hilgraeve Inc.
P.O. Box 941
Monroe, MI 48161
(800) 826-2760
(313) 243-0576
List Price: $149

Requires: 192K RAM, DOS 2.0 or later.

In Short: This full-featured communications package offers fast, reliable file transfer, a high-powered script language that is second to none, and an informative, well-organized interactive tutorial. It's a real pro with tremendous power that's also easy to harness. Not copy protected.

CIRCLE 577 ON READER SERVICE CARD

Performance Tests: Communications Software

To time data transfers from one IBM PC AT to another, PC Labs' performance tests used two different files: a 1-byte ASCII file called OVERHEAD and a 50K ASCII file called TIMING. Each IBM PC AT had the same configuration, and the same communications programs were used on both, allowing us to measure the programs' ability to send and receive data.

The files were tested using the standard Xmodem protocol, which supports checksum for error correction. All of the tested packages can use this error-correction scheme, but some use checksum only when other communicating programs request it. For these packages—*ProComm*, *ProComm Plus*, *Freeway Advanced*, and *BitCom*—CRC error correction was used instead. Although both checksum and CRC transfer data in 128-byte blocks, CRC is inherently slower because of its additional error-checking overhead.

Besides using Xmodem (the one universal option among public-domain protocols), some programs support their own proprietary protocols, which were also tested. In general, these protocols can only be used between copies of the same communications package—or different packages from the same manufacturer. In some cases, however, the proprietary protocols are licensed for use by other manufacturers. The programs we tested with their own protocols were *HyperAccess*, *Professional-YAM*, *Crosstalk XVI* and *Mk.4*, *Freeway Advanced*, *Relay Gold* and *Relay Silver*, *Ascom IV*, *Lync*, and *Softerm*. For comparison, the results of testing with the Xmodem protocol and with the proprietary protocol are shown together for both the TIMING and OVERHEAD files.

The test results for transfer of the TIMING file are representative of real situations. *HyperAccess* performed file transmissions faster than any of the other programs. Both with Xmodem and with its proprietary HyperProtocol, *HyperAccess* came in first.

Crosstalk XVI and *Mk.4* were within the top four. *Crosstalk Mk.4*, with its proprietary protocol, DART, was right behind *HyperAccess*, but *Crosstalk XVI*—using its older Crosstalk protocol—didn't fare nearly as well.

Relay Gold and *Relay Silver* were midroad for Xmodem tests and proprietary protocol tests alike. (Their proprietary protocol is called Relay Bidirectional.) The only difference between the two programs is that *Relay Gold* adds support for mainframe communications. Because the programs are identical for PC-to-PC communications, we decided to test them with *Gold* installed on one AT and *Silver* on the other.

Softerm was the slowest of the packages we tested, both with Xmodem and with a proprietary protocol (Softrans). While transferring data, the program shows the data on the screen, which significantly slows its performance for file transfer.

The results for the OVERHEAD file show the time taken to set up for file transfer and to return control to the keyboard. With Xmodem, *SideTalk*, *Freeway Advanced*, and *Respond/Async* yielded the fastest times. When using a proprietary protocol, *Freeway Advanced* was the fastest program on this test.

Crosstalk XVI and *Mk.4* were again among the top performers when using the Xmodem protocol. As in the TIMING file test, *Crosstalk Mk.4* delivered good performance using DART, while *Crosstalk XVI* was considerably slower using Crosstalk.

In this suite of tests, *HyperAccess* was a decent performer whether using its proprietary protocol or Xmodem. It takes only a moment to set itself up for file transfer, which is insignificant considering its speed in transferring files.

The PC Labs communications program performance tests transferred two files for each protocol tested. The **Overhead** file test was 1 byte long and was designed to time the program's overhead in setting up for transfer and in returning control to the keyboard after transfer was complete. The **Timing** file test was a 50,000-byte text file designed to measure real-case file-transfer speed.

For an across-the-board comparison of file-transfer times, we used the standard Xmodem protocol, with 128-byte blocks and checksum error checking, except in cases where checksum is not available unless another program requests it. In these cases, CRC was used.

For those programs with proprietary file-transfer protocols, we also tested the proprietary protocol. If there was more than one, we tested the fastest protocol (based on manufacturers' claims) designed for use with modems that do not have their own built-in error-correcting feature.

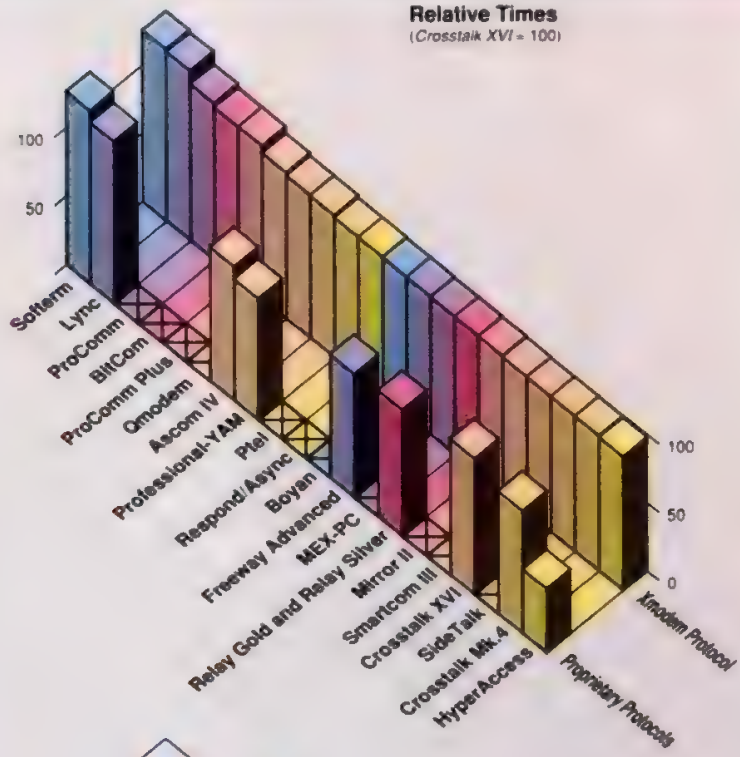
Data compression, when available, was turned off for the Xmodem tests; this ensured that file-transfer time would reflect the speed of both the sending and receiving portions of each program. For proprietary protocols, however, we used data compression, since for these there was no other option.

All the file transfers were measured from the last keystroke command on the controlling side to the moment when control was returned to the keyboard. For Xmodem transfers, this meant setting up both sides individually, then entering the command to start sending on the sending side, followed by the command to start receiving on the receiving side. For proprietary protocols, this often meant setting up one side for remote operation, then controlling the transfer from the other keyboard.

TIMING

Performance Times (Times given in seconds)	Proprietary Protocols	Xmodem Protocol
Softerm	301	306
Lync	251	301
ProComm	N/A	277
BitCom	N/A	270
ProComm Plus	N/A	270
Qmodem	N/A	257
Ascom IV	233	252
Professional-YAM	212	251
Ptel	N/A	247
Respond/Async	N/A	247
Boyan	N/A	246
Freeway Advanced	216	246
MEX-PC	N/A	245
Relay Gold and Relay Silver	221	245
Mirror II	N/A	244
Smartcom III	N/A	242
Crosstalk XVI	237	241
SideTalk	N/A	241
Crosstalk Mk.4	214	240
HyperAccess	112	237

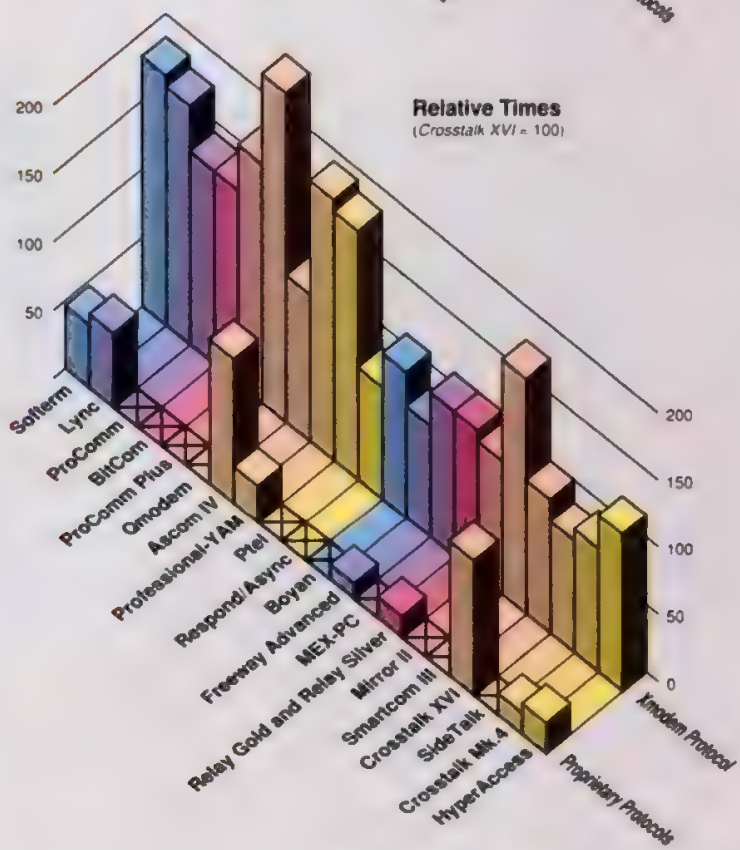
N/A—Not applicable the software offers no proprietary protocol



OVERHEAD

Performance Times (Times given in seconds)	Proprietary Protocols	Xmodem Protocol
Softerm	4.10	2.20
Lync	4.80	2.10
ProComm	N/A	1.70
BitCom	N/A	1.70
ProComm Plus	N/A	2.10
Qmodem	N/A	2.90
Ascom IV	9.40	1.30
Professional-YAM	2.40	2.30
Ptel	N/A	2.20
Respond/Async	N/A	1.00
Boyan	N/A	1.30
Freeway Advanced	1.00	1.00
MEX-PC	N/A	1.30
Relay Gold and Relay Silver	1.40	1.30
Mirror II	N/A	1.20
Smartcom III	N/A	2.10
Crosstalk XVI	8.80	1.20
SideTalk	N/A	1.00
Crosstalk Mk.4	1.40	1.10
HyperAccess	2.00	1.40

N/A—Not applicable the software offers no proprietary protocol



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CIRCLE 326 ON READER SERVICE CARD

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MORE SCRIPT POWER The HyperPilot script language includes string and numeric operators, branching, subroutines, pattern matching, and lots more. It can serve seasoned programmers as well as corporate users. Scripts can be written to hide *HyperAccess* behind a customized menu system and thus give inexperienced users only the choices necessary for their specific communications needs. Hilgraeve also offers site licensing for companies that have large numbers of users.

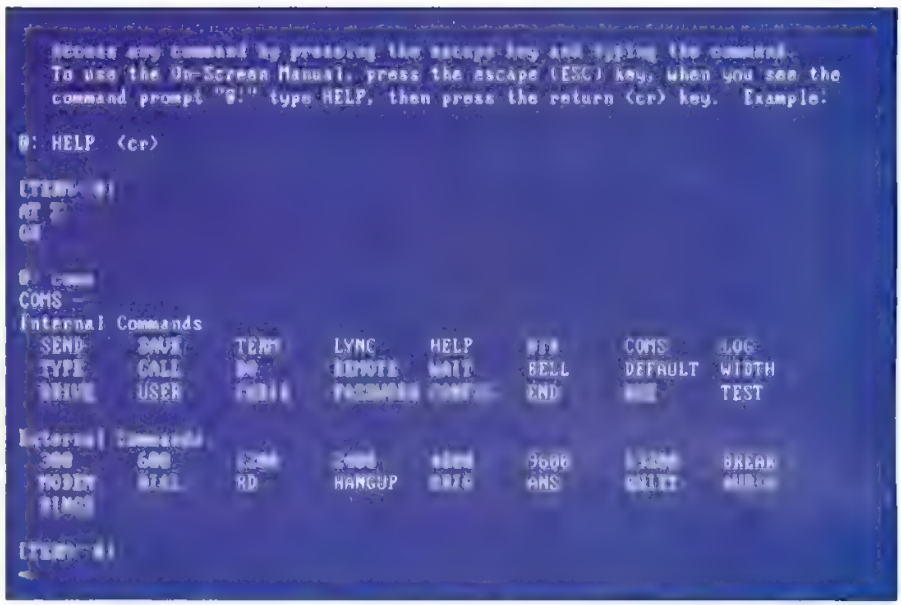
A top-notch, comprehensive, easy-to-use communications package with fast, reliable file transfer and a powerful script language, *HyperAccess* won't let you down.—**Alan Roth and Gary Stein**

.....

Lync

Lync, from Norton-Lambert Corp., was one of the first programs to offer remote PC communications, as well as the ability to transfer various files between different operating systems. Today, 3 years after its fifth and latest major revision, the $195 program remains a portable communications package capable of communicating with minis, mainframes, on-line data and e-mail services, and other PCs.

You install and configure *Lync* by running an installation procedure. Unlike most other communications programs where you have to specify the parameters, *Lync* checks the incoming data and sets these parameters accordingly. The only communications parameter you have to be concerned with is the bit-per-second rate. *Lync* runs on more than 250 different types of computer systems, a claim few other communications packages can make.



All Lync *commands and script (Log) files are accessed from a command line prompt, invoked with the Esc key. The Coms command, shown here, displays a quick list of the commands available at any time.*

When you enter *Lync*, you are placed in terminal mode, where anything you type is sent directly to the modem. *Lync* commands are entered from a command line that you access by using the Esc key. From the terminal mode, options are many: you can communicate with any on-line data service, use one of several methods of uploading/downloading data, dial numbers from a phone list, use script (LOG) files to automate these procedures, and invoke the *Lync* mode.

The *Lync* mode is used either to transfer files with another PC running *Lync* or to establish a remote link with another PC. The *Lync* program uses a proprietary error detection and correction protocol when transferring files between PCs operating in the *Lync* mode.

Remote communications can be established with a PC running any communications program as long as it's in a TTY terminal mode. Passwords can be optionally set up to restrict access to remote machines, but neither computer can transfer files.

INSTRUCTIVE DOCUMENTATION *Lync*'s documentation contains an in-depth "How to" section, helpful to novices, which covers such items as how to automatically sign on to an e-mail service, how to send and save encrypted data, how to make a mini-to-mainframe connection, and how to connect two computers both running *Lync*. A Quick Reference section explains each *Lync* command in more detail, and the remainder of the manual contains information on the advanced features and special options.

Lync contains a script language that allows you to automate dial-up, log-on, and file-transfer procedures. Scripts, called LOG files, can be chained together using *Lync* batch files, which are very much like DOS batch files. Batch files can call *Lync* commands or several LOG files. Both batch and LOG files are executed from the *Lync* command line.

You write a script command much as you would a simple if-then statement: next to a prompt that is listed on the left side of a "marker" character. If the prompt is

PC MAGAZINE FACT FILE

***Lync*, Version 5.0**
Norton-Lambert Corp.
P.O. Box 4085
Santa Barbara, CA
93140
(805) 964-6767
List Price: $195
Requires: 64K RAM, two disk drives, DOS 2.0 or later.
In Short: Entirely command-driven, *Lync* is not for beginners, but its recursive script language makes it particularly attractive. Portability among operating systems, file encryption, and remote communications capabilities make it one to consider for demanding applications. Not copy protected.

CIRCLE 687 ON READER SERVICE CARD

Unretouched Screen Images

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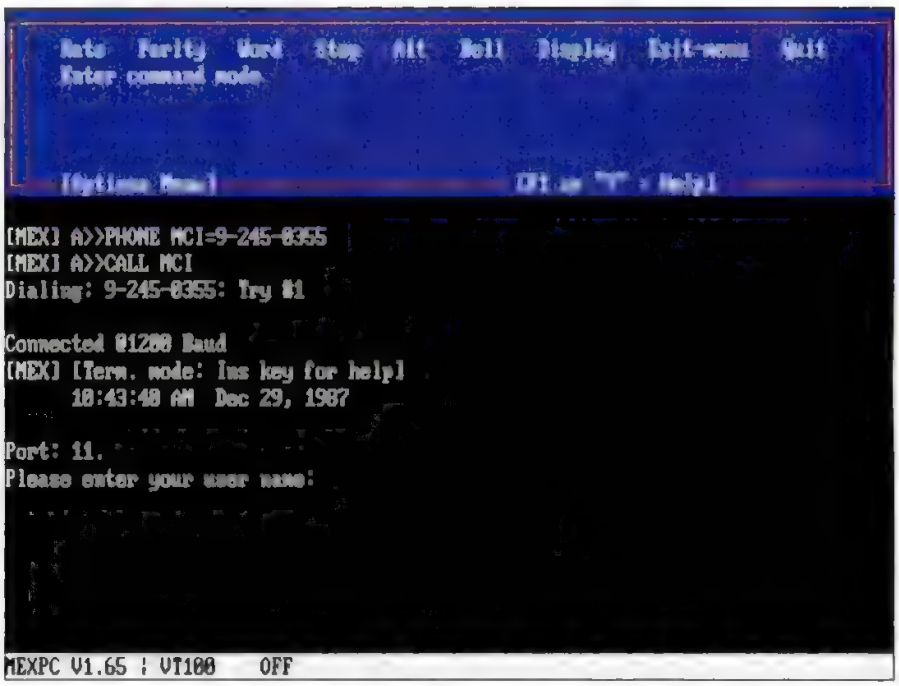
matched during communications, then the *Lync* command on the right side of the marker is executed.

If a prompt is matched out of order in a LOG file, script control will jump to the appropriate prompt and execute that *Lync* command, then jump back to where it left off. This saves you time and effort because you can include all the prompts in the LOG file that you might see, and *Lync* will match only the ones that it finds.

Lync can encrypt files for greater data security on public services. Any files that can be normally transmitted using *Lync* can be encrypted. The sender must specify a code word with the transmitted file, and only this code word can be used to decrypt the file. To encrypt spreadsheet files and other 8-bit files, you include *Lync*'s ASCII convert option to convert the file to ASCII before encryption.

Lync is not for people who rely on menus. You work from an @ sign on the screen and access the command line by pressing the Esc key. Another drawback is that it doesn't have a DOS window. However, you can execute several DOS-like commands from the command line.

Lync is available for many different types of machines and operating systems and does much of the work for you. In fact, a large number of users among the installed base use *Lync* specifically for conversions among various operating systems.—**Greg Alwang**



Once you've passed from menu to command mode, MEX-PC *becomes a much more usable system. Here, a phone number has been assigned to the phrase MCI, which was then used to call the service.*

MEX-PC

MEX-PC, $99.95 from NightOwl Software, seems tailor-made for individualists. Although it gives token help to novices with a simple menu system, *MEX-PC*'s real strength is its flexible, full-featured command language. It's a boon to anyone who prefers to program their communications packages to suit their needs.

The program's menu mode is a way for first-time users to familiarize themselves with the product. A series of point-and-shoot nested commands takes up the top fourth of the screen and opens the program. As you highlight each, an explanatory note appears below it. A tag tells you which menu you're in.

At the menu-mode level, the program allows you only to create phone number files for automatic dialing; you can save only the number and a short explanatory note. You cannot include specific parameters for the service or any log-on procedures. Once you're connected with a service, *MEX-PC* doesn't automatically switch into terminal mode. Instead, you have to toggle back to the menu and call up a separate Conversational menu, which you use to get—finally—into Terminal mode. The procedure is awkward at best.

CLONING ITSELF *MEX-PC* has no install routine. Instead, you save whatever changes you make during a particular session and copy the program. This procedure enables you to start *MEX-PC* immediately in command mode by simply cloning it while you are in that mode.

The command mode is where *MEX-PC* shows its muscle. You activate the command files by using a Do command from the command line. Within a command file, you can perform most of the functions expected of a reasonably sophisticated communications program, including unattended timed operations. You can also easily create personalized menu screens, log the date and the time as the first line of a captured file, call on subroutines, and even run other command files from within your program. The program also works well as a remote terminal.

PC MAGAZINE FACT FILE

***MEX-PC*, Version 1.65**
NightOwl Software Inc.
Route 1, Box 7, Hwy. 12
Fort Atkinson, WI 53538
(800) NITEOWL
(414) 563-4013
List Price: $99.95
Requires: 192K RAM, DOS 2.1 or later.
In Short: Although its menu mode is limited, this reasonably priced program shines in its much more wide-ranging and useful command mode, which includes a relatively sophisticated language. Beginners may find the learning curve too steep, but programmers will find the package worth serious consideration. Not copy protected.

CIRCLE 676 ON READER SERVICE CARD

Quick–turn the page.

STUDY TIME *MEX-PC*'s language is useful once you've learned it, but the manual proceeds at too leisurely a pace. It eventually explains all the commands, but a better-written tutorial would help. Night-Owl Software does include several well-labeled command scripts. Unfortunately, on the whole they're too complex to be of real help to beginners. A more basic sample sign-on script would be useful.

MEX-PC has a lot to offer do-it-yourself programmers, but its menu-driven mode is weak—and its name doesn't tell the story. Hold the salsa—MEX stands for Modem Executive.—**Barbara Krasnoff**

Mirror II

When *Mirror*, from SoftKlone Distributing Corp., was first released, it was an unabashed clone of *Crosstalk XVI*—even down to the *Crosstalk* status screen. Microstuf (then the manufacturer of *Crosstalk*) cried foul and won a ruling stating that the screens were protected by copyright. SoftKlone responded by redesigning the screens. The result is *Mirror II*, a program that looks different from *Crosstalk XVI* but includes all the *Crosstalk* commands, adds significant new features and sells for just $69.95.

If *Mirror II* did no more than copy *Crosstalk XVI*, there would be little to say about it. What makes the program interesting are the differences. Consider the script language, for example. The *Mirror II* language includes all of the *Crosstalk* commands, so the program can run any script written for *Crosstalk*. It also includes enhancements. Most notably, *Mirror* adds a learn mode for automatically creating scripts. Once it is created, you can edit the script with a word processor or with *Mirror*'s own editor.

On first glance, the Mirror II *status screen bears little resemblance to the* Crosstalk XVI *screen—except for the Command? prompt on the bottom line. The parameter settings are divided into two sections, or "boxes," on the upper half of the screen.*

REDESIGNED SCREENS Ironically, *Mirror II*'s redesigned screens also offer an advantage over *Crosstalk*. The *Crosstalk* status screen has so much information that it can be overwhelming. Until you learn to ignore most of the screen, the information you really need can get lost in the crowd.

Mirror II eases the information overload. The program divides its settings into categories—including port settings, security features, connection parameters, and system settings. With three to nine settings in each category and a maximum of only two categories showing at once, the display screen is far easier to read. A simple Ctrl-key combination lets you scan through the different categories as needed.

The *Mirror II* help feature is another plus. With *Crosstalk XVI*, you can ask for information on any command, but that helps only if you already know which command you want information on. *Mirror II* adds help in finding the right command when you don't know which one you need. You can, for example, pick Binary File Transfer from the help menu, and *Mirror* will show you a list of file transfer commands along with short explanations of each. In most circumstances, this is a more useful approach.

A DRAMATIC ADDITION The most dramatic additional feature in *Mirror* is background operation. As with *Crosstalk*, you can run *Mirror II* in the foreground and clear it from memory by leaving it with the Quit command. However, you can also leave *Mirror* by way of a hotkey. This lets you load another program while *Mirror II* keeps operating in the background—redialing a busy bulletin board, automatically answering incoming calls, continuing a file transfer, or simply waiting for you to call it up again.

PC MAGAZINE FACT FILE

***Mirror II*,**
Version 3.6.12
SoftKlone Distributing Corp
336 Office Plaza Dr.
Tallahassee, FL 32301
(800) 634-8670
(904) 878-8564

List Price: $69.95
Requires: 192K RAM, DOS 2.0 or later.
In Short: This clone of *Crosstalk XVI* offers a more readable status screen than *Crosstalk*'s, a better help system, background operation, additional file-transfer protocols, and additional terminal emulations—all at a substantially lower price. Not copy protected.

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Then you can turn *this* page too.

Lotus Graphwriter II

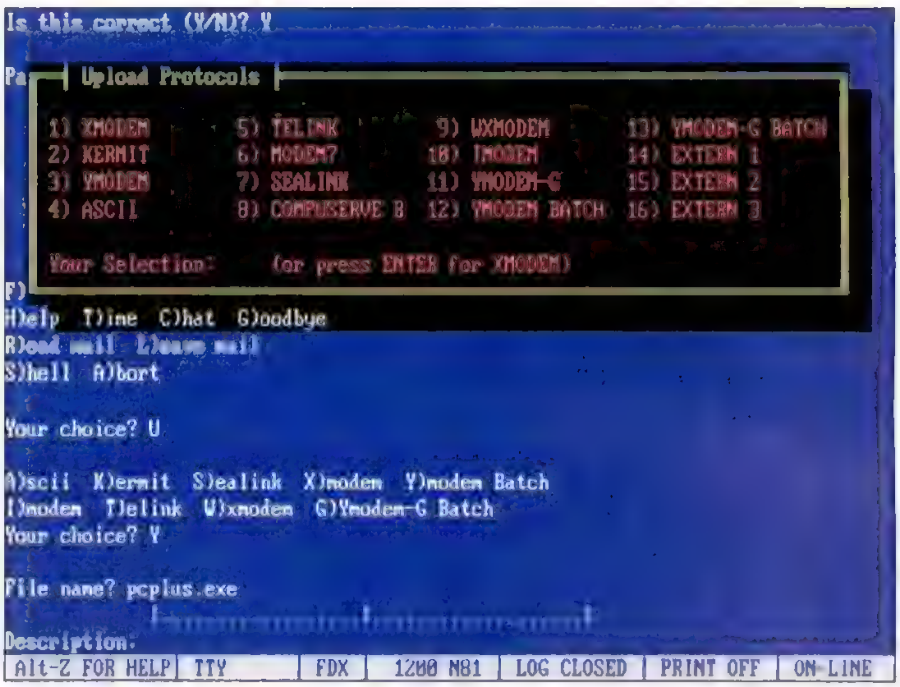
Lotus Graphwriter II

*Graphwriter II demonstration kit requires an IBM® PC or compatible, 256K and a graphics card. © 1988 Lotus Development Corporation. Lotus, 1-2-3, Graphwriter, and Symphony are registered trademarks of Lotus Development Corporation. dBase is a registered trademark of Ashton-Tate. IBM is a registered trademark of International Business Machines Corporation.

The background operation is not entirely stable. In testing for this review, the program crashed twice—both times while hot-keying out of *Mirror*. Even so, background operation is a seductive feature. Just be sure to approach it skeptically and save your work more often than usual.

Also worth noting is that *Mirror* offers 11 terminal emulations compared with *Crosstalk*'s 6. And to *Crosstalk*'s Xmodem, Kermit, and proprietary protocols, *Mirror II* adds Xmodem-CRC with fallback, Modem7 batch, Ymodem batch, Ymodem-G, and the Hayes Smartcom II protocol.

By any measure, *Mirror II* is a good value. If you're not interested in script files or background operation, there are easier programs to learn and use. But if you're serious about communications—and particularly if you're a *Crosstalk* user who has already invested time and effort in developing scripts—*Mirror II* is worth a close look. If you like *Crosstalk*, you should love *Mirror*. If you don't like *Crosstalk*, you may very well like *Mirror* anyway.
—M. David Stone



While ProComm Plus *talks to a* ProComm Plus *host, several protocol choices for file transfer appear in both the program's host menu and the exploding upload window. Note the Read Mail and Leave Mail choices; the mail feature turns* ProComm Plus *into a BBS.*

ProComm
ProComm Plus

Datastorm Technologies' *ProComm* and its new *ProComm Plus*—the first a popular $50 shareware program, and the second a $75 commercial product—are like elegantly engineered German touring cars at the price of Korean subcompacts: they'll deliver on performance, but they won't break the bank.

ProComm has been available through shareware channels for several years and stands up against the toughest competition from the commercial communications software products. *ProComm Plus* is an enhanced version of *ProComm*. It is not meant to replace the shareware version but to sell alongside it as a slightly more expensive, more feature-laden sibling.

A LOT ALIKE The two versions of *ProComm* have much in common. Either program lets you set your preferred values for most defaults. Both provide limited DOS services through file view, change directory, and directory list commands. Both versions also include a DOS shell gateway feature to let you access DOS without breaking communications. In both cases, the screens are notable for being uncluttered. And *ProComm Plus* maintains the famous *ProComm* "exploding windows," which make a chirping noise as they expand. (The feature can be turned off in both versions.)

Most differences between the versions are straightforward additions. For example, *ProComm Plus* includes its own text editor—a feature missing from *ProComm*. However, as with the shareware version, *ProComm Plus* lets you install your favorite text editor as the program's default.

The few changes in *ProComm Plus*—as opposed to additions—have all been made for a good reason. For example, the help window in *ProComm Plus* has been rearranged to make commands easier to find. Similarly, the key for calling up the help screen has been changed from Alt-F10 to Alt-Z, in recognition that IBM's new keyboard layout makes the Alt-F10 combination somewhat clumsy.

The dialing directory in *ProComm* holds 100 entries. The *ProComm Plus* directory holds 200 entries and allows multiple directories. Each entry includes a 24-character description, telephone number, communications parameters, and, optionally, the name of the script to automatically run when connection is established. The automatic redialing feature in *ProComm* has been enhanced in *ProComm Plus* to let you dial several busy numbers in a circular queue. You can direct an activity log of a communications session to a file or to your printer in either version.

UNATTENDED REMOTE FILE TRANSFER The Host mode in both versions offers a simple approach to unattended remote file transfer, complete with password protection. *ProComm* supplies one password for all users, plus a second password for access to DOS level. *ProComm Plus* lets you set up a user file, including password, user name, and privilege level (limited or complete access) for each user. Individual passwords combined with the usage log let you keep track of who is using your system. A built-in message facility turns the *ProComm Plus* Host

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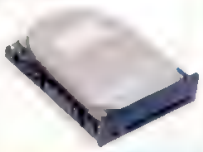

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Editor's Choice
Feb 16, 1988

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— Alfred Poor
PC Magazine, Feb. 16, 1988

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$995

Standard-286/12

- 6MHz-12MHz Switch-Selectable Speed
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Standard-286/8

- 6MHz-8MHz Switch-Selectable Speed
- 512KB RAM

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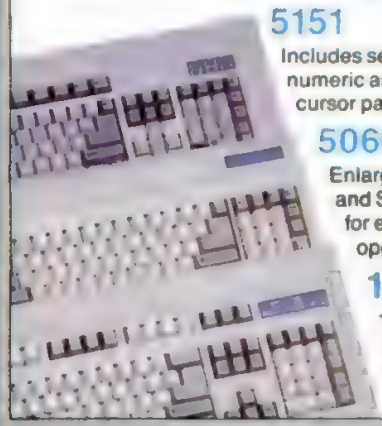
Editor's Choice
Feb. 16, 1987

Keyboards



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May 31, 1988

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Monographics Video-High-resolution (750 pixels × 350 lines) amber monochrome monitor with 12" screen, monochrome graphics card with parallel port.

Hard Drive- 20MB hard drive, fully installed.

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Printer-Epson® LX-800 with draft (150-180CPS) or near letter quality printing, multiple typestyles, Epson character graphics set, dot graphics capability.

Software-Professional Zen Software, a totally integrated software package: **ZenWord**™, **ZenCalc**™, and **ZenLink**™. **MS-DOS**® operating system, **GW BASIC**® programming language, and **PC FullBak** backup utilities also are included.

Accessories-200 sheets continuous form paper, printer cable, and 10 double-sided, high-density blank diskettes.

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Accessories-200 sheets continuous form paper, printer cable, and 10 double-sided, double-density blank diskettes.

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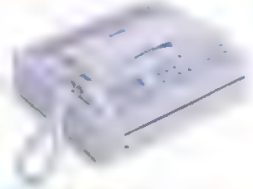

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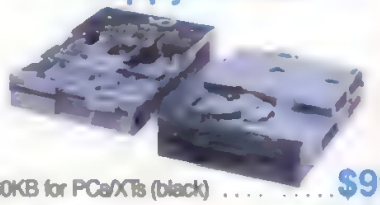

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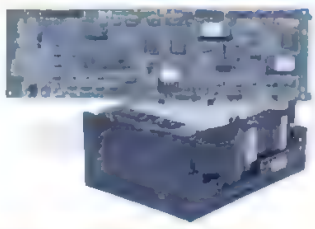

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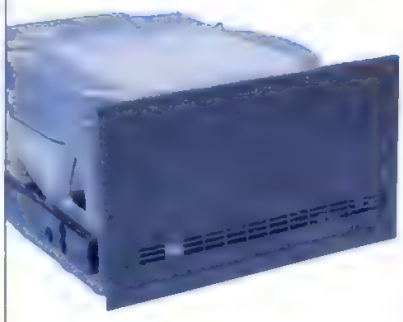

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PC MAGAZINE
Editor's Choice
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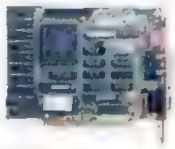

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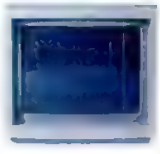

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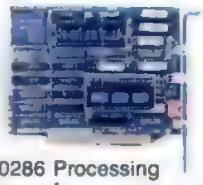

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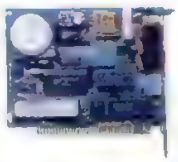

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CIRCLE 279 ON READER SERVICE CARD

mode into a simple BBS system as well.

One of *ProComm*'s strong points is its wide range of eight file-transfer protocols. The *ProComm* menu choices include Xmodem (actually Xmodem-CRC with fallback), Modem7, Ymodem (actually Xmodem 1K), Ymodem batch, Telink, WXmodem, Kermit (with sliding windows and data compression), and CompuServe-B. *ProComm Plus* adds such protocols as Sealink, Imodem, Ymodem-G (actually a streaming Xmodem 1K), and YmodemG batch, as well as CompuServe Quick-B.

Terminal emulation is another plus. *ProComm* offers emulations for an impressive list of popular terminals: the well-known DEC VT-52 and VT-100, and IBM 3101 terminals, as well as selected models from TeleVideo, ADM, Heath, ADDS, and Wyse. It also provides ANSI emulation for a total of ten emulations. *ProComm Plus* adds five additional models in the same product families.

ENHANCED SCRIPT LANGUAGE With either version of *ProComm*, you can attach scripts to a dialing directory entry. You can also call a script from within another script or invoke a script when starting the program. Script control commands in *ProComm* include simple decision (If), case statement, execution of an internal subroutine, and jump (GOTO). The *ProComm Plus* script language, called Aspect, is a greatly enhanced version of the *ProComm* language. New features include looping commands, display control commands, additional string-handling commands, and mathematical functions. Most important for ease of use, *ProComm Plus* has a learn mode for automatically creating scripts.

ProComm comes on one disk, in a compressed format called ARC, for archive. To install it, you run the supplied archive-extracting program and copy it to your working disk or directory. You can then start the program and set the defaults. The *ProComm* manual is included on-disk. A printed version is optional. *ProComm Plus* comes on two disks. The files are in a noncompressed format and are accompanied by a slick installation program. The install program includes a configuration routine that will help you set your initial defaults. *ProComm Plus* also comes with a printed manual as standard.

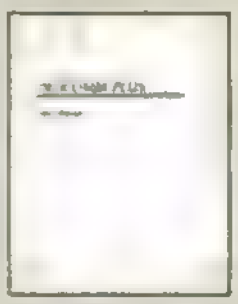
A GOOD VALUE *ProComm* is an excellent communications tool that can satisfy the needs of most users. *ProComm Plus*, for a modest additional price, offers extra features as icing on an already attractive cake. Both versions of the program are easy to use and packed with features. Although performance in file transfer is slower than with many other programs, this should be an issue only if you do a great deal of file transfer at long-distance rates. For most purposes, *ProComm*'s performance is adequate. If your communications needs are casual to moderate, either version of *ProComm* is a good choice. **—Kenneth H. Werner and M. David Stone**

PC MAGAZINE FACT FILE

Datastorm Technologies Inc
P.O. Box 1471
Columbia, MO 65205
(314) 474-8461

***ProComm*, Version 2.4.2**
List Price: $50
Requires: 128K RAM, DOS 2.0 or later.

CIRCLE **674** ON READER SERVICE CARD



***ProComm Plus*, Version 1.0**
List Price: $75
Requires: 192K RAM, DOS 2.0 or later.
In Short: This popular shareware program is easy to learn and use yet offers a full range of features, including a choice of eight file transfer protocols, ten terminal emulations, a password-protected host mode for remote file transfer, and a full-function script language—all at a low price. *ProComm Plus*, best thought of as an enhanced version of *ProComm*, includes all the features of the popular shareware program plus such improvements as a companion text editor, more-readable screens, individual passwords for the program's host mode, and additional file-transfer protocols. If you like *ProComm*, the extra $25 for *ProComm Plus* is well worth it. Not copy protected.

CIRCLE **673** ON READER SERVICE CARD

Professional-YAM

At first glance, *Professional-YAM* can be intimidating. It looks like the ideal communications program for people who feel that DEBUG is as friendly a word processor as they will ever need.

Omen Technology makes the program available through an interesting procedure in which you simply call up CompuServe or GEnie, or Telegodzilla, the Omen BBS—and download a squeezed version of the program. Once you register the program, you receive a serial number and a distribution disk with files to unsqueeze the program files and bring *Professional-YAM* to life. You cannot get a working copy without a valid serial number, but, after you get one, you can copy the program at will, and your serial number entitles you to free program updates.

The features in this $139 package could fill a small book. *Pro-YAM* has an incredible command language. The reference card lists more than 400 commands, parameters, and other settings that you can access from the command line. You can also incorporate these into scripts that can automate everything from unattended file transfers to reminders to call home to say you will be late for dinner.

File-handling commands let you look at the contents of files, cut out sections, and append them to other files. You can

PC MAGAZINE FACT FILE

Omen

***Professional-YAM*, Version 17.01**
Omen Technology
17505-V NW Sauvie Island Rd
Portland, OR 97231
(503) 621-3406
List Price: $139
Requires: 96K window (256K RAM recommended), two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: *Professional-YAM* is not a program for newcomers to communications. But its range of commands and the sheer number of file-transfer protocols available may make it the program of choice for those who can put up with its command-based interface. Not copy protected.

CIRCLE **686** ON READER SERVICE CARD

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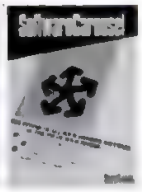

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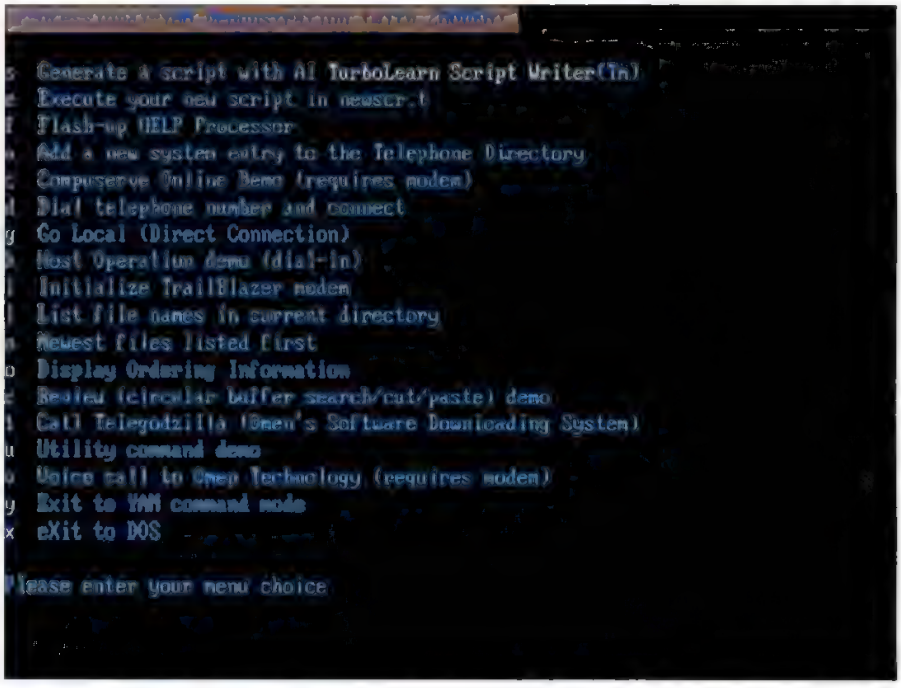


Professional-YAM *comes with a demonstration script that includes this menu of options—an example of how the* Pro-YAM *interface can be simplified for users through careful script programming.*

browse through directories half a dozen different ways. You can even drop into DOS and issue a command directly.

If you don't feel up to writing complex scripts, the default script automates many procedures for you, such as setting function-key and Alt-key combinations. You can toggle into terminal mode and back to command mode. You can manually dial a number with one command. You can even ask the program to prompt you through the dial-up process, and it will construct a script by recording a communications session and capturing both the host prompts and your responses.

WHAT MORE? *Professional-YAM* offers multiple types of security and encryption, host mode for remote access, automatic logging of incoming and outgoing transactions, nine or more different transfer protocols, and the ability to work with nearly any modem. One protocol is Zmodem, touted to be one of the fastest and most reliable available. What more could anyone want?

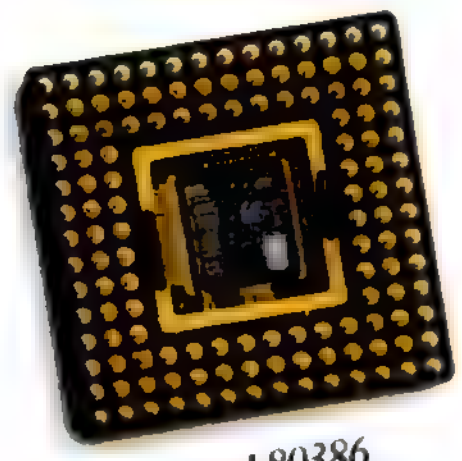
Well, some people would like a program that is easier to use. You can create a script that presents menus and such on the screen, but you have to write it. Not everyone needs seven different DIRectory commands. And many people may be put off by the effort required to get up to speed with this program.

One problem is the manual. It is written in a dense style, with endless lists of parameters and commands and few examples to make usage clear. The two "tutorials" require careful examination of the hypothetical scripts and communications sessions listed in the book with brief annotations. These tutorials don't even appear until Chapters 8 and 25 (out of 35).

Everything in the product is configurable; nothing is static. *Pro-YAM* is also available under Unix, and its influence seems to permeate the program. For example, DOS paths must be specified with the forward slash, /, because the backslash, \, is used by Unix as a command trigger.

Novices may find all this confusing. Indeed, the program displays a bias towards programmers. You can specify an ASCII character to be sent using the Put command, but there are only two number bases that can be used. One is hexadecimal (base

This chip is too smart to be in a personal computer.



The Intel 80386 microprocessor

Introducing the corporate 386.

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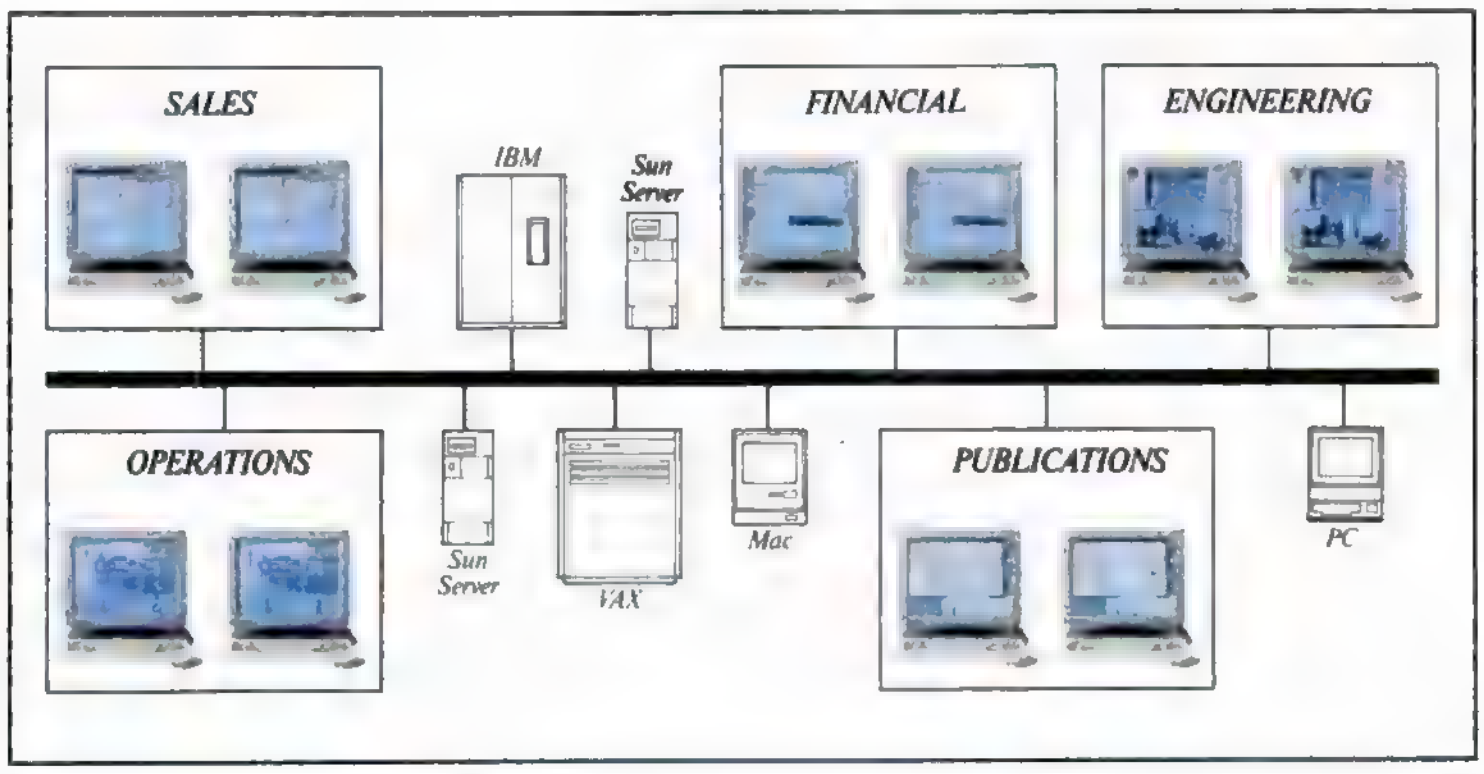

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16), which is reasonable enough, but the other is not base 10 (the decimal system, based on a total complement of fingers) as you might expect. It is octal (base 8, as in "forget you have thumbs"). Perfect for those of us who waste all that time translating the actual binary codes for ASCII characters into those troublesome decimal values, but a little hard on the uninitiated.

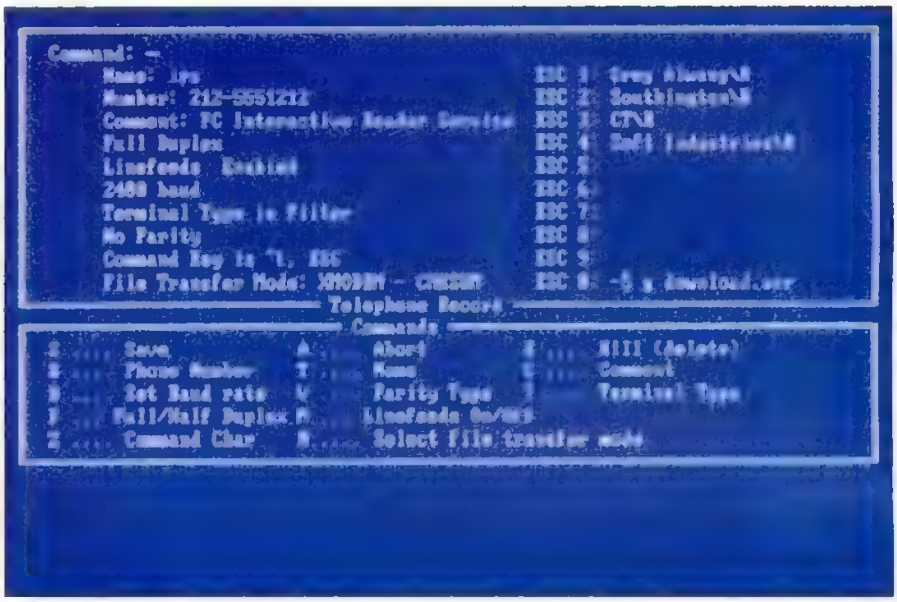
If you want to take charge of your communications applications or may be having problems with your current system, *Professional-YAM* may be worth a look. On the other hand, if you don't want to invest a lot of time getting on-line, *Professional-YAM* is not for you.—**Alfred Poor**

•••••

Ptel

Phoenix Technologies' *Ptel*, priced at only $49, can transfer text and binary files and communicate with on-line data services as well as micros, minicomputers, and mainframes. It has a full-featured telephone directory and a powerful script language. And its key combinations let you bypass the command menu for fast, easy access to all commands.

To install *Ptel*, you copy the files from the distribution disk onto the hard disk and run the PTELUP installation program. PTELUP prompts you for most of the communications parameters. The settings act as defaults, but you can change most, except for the modem type, from within the program.



The Ptel *telephone directory allows you to enter many communications parameters and other useful information for each directory entry. A script command in the Esc 0 command slot will be automatically executed when a connection is made.*

From the command line, you can invoke a command menu that doubles as a help screen, listing each command and the key associated with it. You can also issue commands from the terminal mode, using a "quick-key" combination to bypass the command menu.

Each telephone-directory entry includes ten slots for entering additional data or keystrokes that you need to send to the remote system. *Ptel* treats each Esc slot as a short script file, but the last slot is reserved for an auto-log-on script. The program automatically invokes this command as soon as communications are established. Commands can be used to call other script files.

DEFAULT PROTOCOL PLUSES *Ptel* can use Xmodem, Xmodem-CRC with fallback, Modem7 Batch, Kermit, or Telink protocols. The program uses Telink with CRC error correction as the default. Telink checks the serial numbers of *Ptel* copies. If the same copy of *Ptel* has been installed on two different computers, Telink will recognize the duplication and prohibit file transfers between them.

When *Ptel* encounters an error during a file transfer, it tries to resend the information up to ten times. If the final attempt to transfer is unsuccessful, *Ptel* prompts you to tell it whether or not to continue. It will then continue or abort the transmission accordingly.

You can specify unattended operation by using a script command. In this case, *Ptel* will set an error flag wherever needed so that script commands can detect the error. Another useful feature for unattended operation is automatic redial until a connection is made.

SPEAKING THE LANGUAGE *Ptel*'s line-oriented, interpretive script language is a lot like BASIC and is easy to use. You are given several sample script files that illustrate its many uses. The language allows subroutine calls to other script files (up to ten levels deep) and offers loops by means of labels and GOTO commands.

Several different types of variables make designing script files easy. An intelligent error-trapping variable automatically sets an error flag and then branches to a previously specified label. A special Z command allows you to have the system

PC MAGAZINE FACT FILE

***Ptel*, Version 4.0**
Phoenix Technologies Ltd.
320 Norwood Park South
Norwood, MA 02062
(800) 344-7200
(617) 769-7020
List Price: $49

Requires: 150K RAM, DOS 2.0 or later.
In Short: This low-priced yet full-featured program supports popular file transfer protocols. It's easy to learn and use and it lets you execute all commands by using keystroke combinations as well as from the menu. The script language, which allows subroutine calls and conditional branching, is more than adequate for automating everyday communications procedures. Not copy protected.

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CPU 386/16
Monitor Not Included

CPU 286/P
Includes LCD Display

	CPU 386/20	CPU 386/16	CPU 286/P
Standard Features			
CPU	80386-20	80386-16	80286-12
Clock Speed (MHz)	8/16, 10/20	8/16	6, 8/12
Wait State	Zero	Zero	Zero, Norton V3 SI rating: 15.3
RAM	1MB static column	1MB static column	512K DRAM (80ns)
On Board Expansion Memory	Up to 4MB	Up to 4MB	Up to 4MB
System Expansion Memory	Up to 12MB	Up to 12MB	Up to 16MB
Math Co-Processor Support	80287/80387	80287/80387	80287
Controller Card Handles	2 hard disks, 2 floppies	2 hard disks, 2 floppies	1 hard disk, 1 floppy
Disk Drive(s) Included	1.2MB floppy drive	1.2MB floppy drive	20MB hard drive, 1.44MB floppy drive
Clock/Calendar	Yes	Yes	Yes, with 10-year battery life
Ports	2 serial, 1 parallel, joystick adapter	2 serial, 1 parallel, joystick adapter	2 serial, 1 parallel, joystick adapter
Expansion Slots	1 32-bit memory bus, 5 16-bit, 2 8-bit	1 32-bit memory bus, 5 16-bit, 2 8-bit	3 16-bit, 2 8-bit
Keyboard	101-key enhanced	101-key enhanced	86-key
Power Supply (watts)	200	200	200
Reset Switch	Yes	Yes	Yes, with 2-second safety delay
BIOS	Award 32-bit ROM	Award 32-bit ROM	Phoenix
Warranty	1 year	1 year	1 year
System Configurations			
Monochrome System w/Hard Drive	$2,735 $3,130 (40MB)	$2,035 $2,430 (40MB)	n/a $1,795 (20MB)
EGA System w/Hard Drive	$3,185 $3,580 (40MB)	$2,485 $2,880 (40MB)	n/a n/a
Special Note	Also available as CPU 386/20 Tower (optional). Made in U.S.A.	Also available as CPU 386/16 Tower (optional). Made in U.S.A.	22-pound portable includes 20MB hard drive and Supertwist EL backlit LCD. Made in U.S.A.

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Monitor Not Included

CPU 286/10

Monitor not included

CPU TURBO XT

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CPU	80286-12	80286-10	8088-1
Clock Speed (MHz)	6, 8/12	6, 8/10	4.77/10
Wait State	Zero, Norton V3 SI rating: 15.3	Zero, Norton V3 SI rating: 11.5	Zero
RAM	512K DRAM (80ns)	512K DRAM (100ns)	640K
On Board Expansion Memory	Up to 4MB	Up to 4MB	Up to 640K
System Expansion Memory	Up to 16MB	Up to 16MB	Up to 8MB EMS
Math Co-Processor Support	80287	80287	8087
Controller Card Handles	2 hard disks, 2 floppies	2 hard disks, 2 floppies	2 floppies
Disk Drive(s) Included	1.2MB floppy drive	1.2MB floppy drive	360K floppy drive
Clock/Calendar	Yes, with 10-year battery life	Yes, with 10-year battery life	Yes
Ports	2 serial, 1 parallel, joystick adapter	2 serial, 1 parallel, joystick adapter	1 serial, 2 parallel, game port
Expansion Slots	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	8 8-bit
Keyboard	101-key enhanced	101-key enhanced	84-key standard
Power Supply (watts)	200	200	150
Reset Switch	Yes, with 2-second safety delay	Yes, with 2-second safety delay	Yes
BIOS	Phoenix	Phoenix	DTK
Warranty	18 months	18 months	1 year
System Configurations			
Monochrome System w/Hard Drive	$1,135 $1,530 (40MB)	$1,035 $1,285 (20MB)	$595 $890 (20MB)
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Special Note	Features Selectable System Bus Timing for add-on board compatibility. Made in U.S.A.	Also available in optional full size case with five drive bays. Made in U.S.A.	$595 Complete. Includes 12" high resolution monitor and Hercules compatible graphics card.

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wait until a specified time of day to continue processing, which is ideal for unattended operation. However, *Ptel* offers only remote file-transfer features rather than full-fledged remote operations.

Ptel's documentation is clear and concise. The tutorial section dives right into the script language. It begins by walking you through a prewritten script designed for logging on to an on-line service.

An inexpensive communications program with a full-featured script language, *Ptel* is a no-frills, no-headache program.—**Greg Alwang**

Qmodem

Qmodem, a popular shareware communications program, was long a favorite of the BBS crowd. Recently eclipsed by *ProComm* and *Boyan*, *Qmodem* came roaring back with a new version, renamed *Qmodem SST*, Version 3.1, and packed with exciting features.

Qmodem author John Friel maintains a bulletin board from which you can receive the program and participate in conferences with persons producing beta protocols. You can purchase *Qmodem* through the bulletin board as well, making payments on-line with your credit card. The price of the program is $50.

Hooks in *Qmodem* permit it to call outside programs that implement new error-correcting protocols besides those built into the program. In the current version of *Qmodem*, external protocols include Kermit and windowed Xmodem (sliding windows), as well as protocols designed to work with the newer modems that perform their own error correction.

Qmodem's main help screen shows the rich set of functions available at a keystroke. Note that your choice of external editors may be installed to replace the program's Edlin default.

QINSTALL, the install routine in *Qmodem*, allows access to virtually every feature and parameter setting you might wish to change in the program, including colors and window location, as well as the usual communications and hardware parameters.

You can change settings while *Qmodem* is running. Better yet, QINSTALL has fully context-sensitive help. When you set a parameter, you can press F1 to receive a lucid explanation of its importance and meaning. *Qmodem*'s manual is outstanding and includes a comprehensive index and a handy reference guide to the script language.

Qmodem's powerful script language includes a number of exciting capabilities, such as built-in commands that let you create menus in your scripts. You can handle input information in many ways. One is with the Get command, which simply accepts the keyed information into a variable. You can also read information from the data feed to which you're connected. The program permits looping and branching based on an indexed variable. A Push and Pop stack facility and subroutine handler permits flexible script design. *Qmodem* gives you the ability to call one script from within another, and a DEBUG facility lets you test a script as you create it. Editing is done through a file view facility that can be simply tailored to your use.

You can execute a script three ways: by linking a script to a number in the dialing directory and then entering the number, by invoking Alt-F, or by attaching it to a macro key. Keyboard macros provide a handy tool with which you may assign up to 40 key combinations (various shifted and unshifted states of the function keys).

Four terminal emulation modes are supported, and there is an option to exit but leave DTR set so that you don't drop your line if you have to leave the program.

SCROLLING SCRIPTS *Qmodem*'s DOS shell is robust and doesn't need much memory for basic operation. You can run quite a few products within the shell if you

FACT FILE

***Qmodem*, Version 3.1A**
The Forbin Project
P.O. Box 702
Cedar Falls, IA 50613
(319) 232-4516
List Price: $50 (with disk and manual).
Requires: 256K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: Popular shareware product. Lacks automatic host mode and auto-dialback, but versatile script language lets you program those abilities. Not copy protected.

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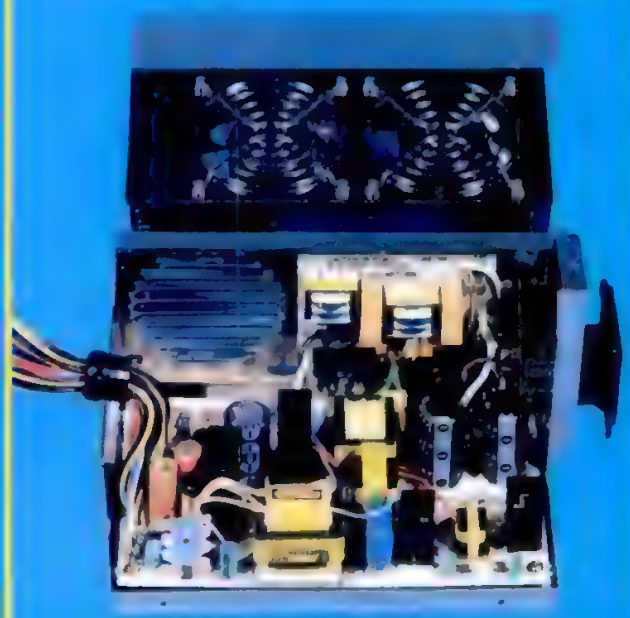

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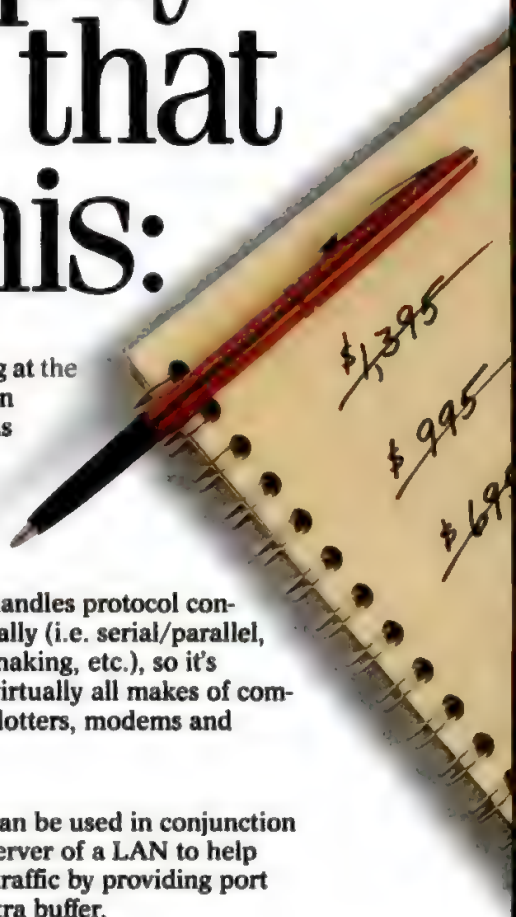

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• Print Master II makes choosing a connection as easy as moving your cursor. You select where you want your data to go from a pop-up menu generated by BayTech's memory resident program.

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• Print Master II's serial ports operate at *real* speeds up to 9600 baud, even when all ports are operating at the same time. You can set baud rates, plus other configuration changes, for each port.

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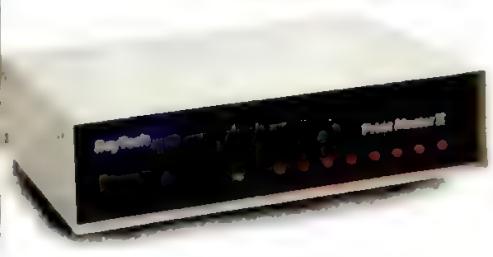
• Print Master II can be used in conjunction with the printer server of a LAN to help off-load network traffic by providing port expansion and extra buffer.

• Print Master II features many little extras that make a big difference in performance: shielded connectors, a built-in power supply, easy-to-read configuration menus, fewer parts for higher reliability, sturdy metal case.



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haven't used the extensive buffer expansion capabilities. However, when you need scrollback capability to go back within a session, or if you want to expand the download buffer to reduce dependence on disk writes, you may easily do so within QINSTALL. In fact, paging through the scrollback buffer is a nice way to develop scripts: log the session, scroll back, use the screen capture facility, and edit the file created by the capture. It's sort of a poor man's learn mode.

Qmodem does not include a timed execution facility but does have an excellent circular dialing facility that can allow unattended operation. The time between redials may be specified, and you can log activity for inspection the next day.

Qmodem comes with a series of easy-to-edit scripts for services like CompuServe and MCI Mail, as well as BBS software. Background operation can be done with only OS/2 or programs like *DESQview* that have their own facilities for background processing.

You also will not find an embedded host mode, although there is a series of interrelated scripts that will permit host operation. The program doesn't do an automatic dialback, but programming it to do so would not be that difficult. Considering how attractive the rest of the program is, it would be a shame if the need for an automatic host mode was all that stood between you and *Qmodem*.—**Merv Adrian**

In Relay Silver, *as well as in* Gold, *details specific to every entry in the directory are stored on a separate options page. Explanatory screens for each parameter are available at the push of a button, and a log-on script to automate a given communications session may be indicated.*

Relay Gold
Relay Silver

Relay Gold and *Relay Silver*, Editor's Choices in previous *PC Magazine* communications software reviews, go far beyond the conventional terminal emulation and file transfer capabilities of most commercial products.

Produced by VM Personal Computing, *Relay Gold* and *Silver* possess the same core. However, besides handling an array of PC-to-PC communications functions, *Relay Gold* can work together with proprietary mainframe software to allow file transfer between PCs and large mainframes. *Gold* allows 3270 terminal emulation in software or through its support of PC emulation boards, while *Silver* is aimed at users who do not need the specialized mainframe abilities of *Relay Gold*. The two programs are identical in every other respect, and all the features described here pertain to both. *Gold* lists for $250, while *Silver* costs $150.

Both possess multitasking features that allow file transfer, text editing, and printing activities to be conducted simultaneously. The rich scripting language common to both programs allows automated control of all aspects of communications.

Don't think, however, that these advanced features mean complex tasks and bumpy learning curves for the user. Both programs present a clear, consistent menu-driven user interface that beginners can use with a minimum of training. Context-sensitive help is a keystroke away, and the products are preconfigured to handle most popular modems and on-line services.

The tutorial simulates almost every phase of *Relay* operation and is an excellent introduction to its use. Another program makes installation and configuration of *Relay* practically painless. A surprisingly complete Getting Started booklet takes the new user through the necessary steps.

Computers with which *Relay* may communicate are listed in a directory that contains phone numbers, terminal types, bit-per-second rates, and comments. For each entry in the directory, one may also specify a full range of protocol and handshaking particulars, details on remapping the keyboard, and a script that will automatically handle all log-on procedures.

Relay comes with a directory of computers that is preloaded with many common configurations. Sample entries are supplied for commercial services such as CompuServe and Dow Jones News/Retrieval, for common bulletin board systems like RBBS and FIDO, and for generic TTY and mainframe links. *Relay* has its own proprietary protocol for use between any two PCs running versions of *Relay*. This allows groups of files to be specified for transfer using the DOS wildcard characters, and the machines can both send and receive files simultaneously. Furthermore, users at each PC can chat from the keyboard during file transfer.

The log-on script for each entry in the directory may be created using the com-

To some people, the difference is obvious.

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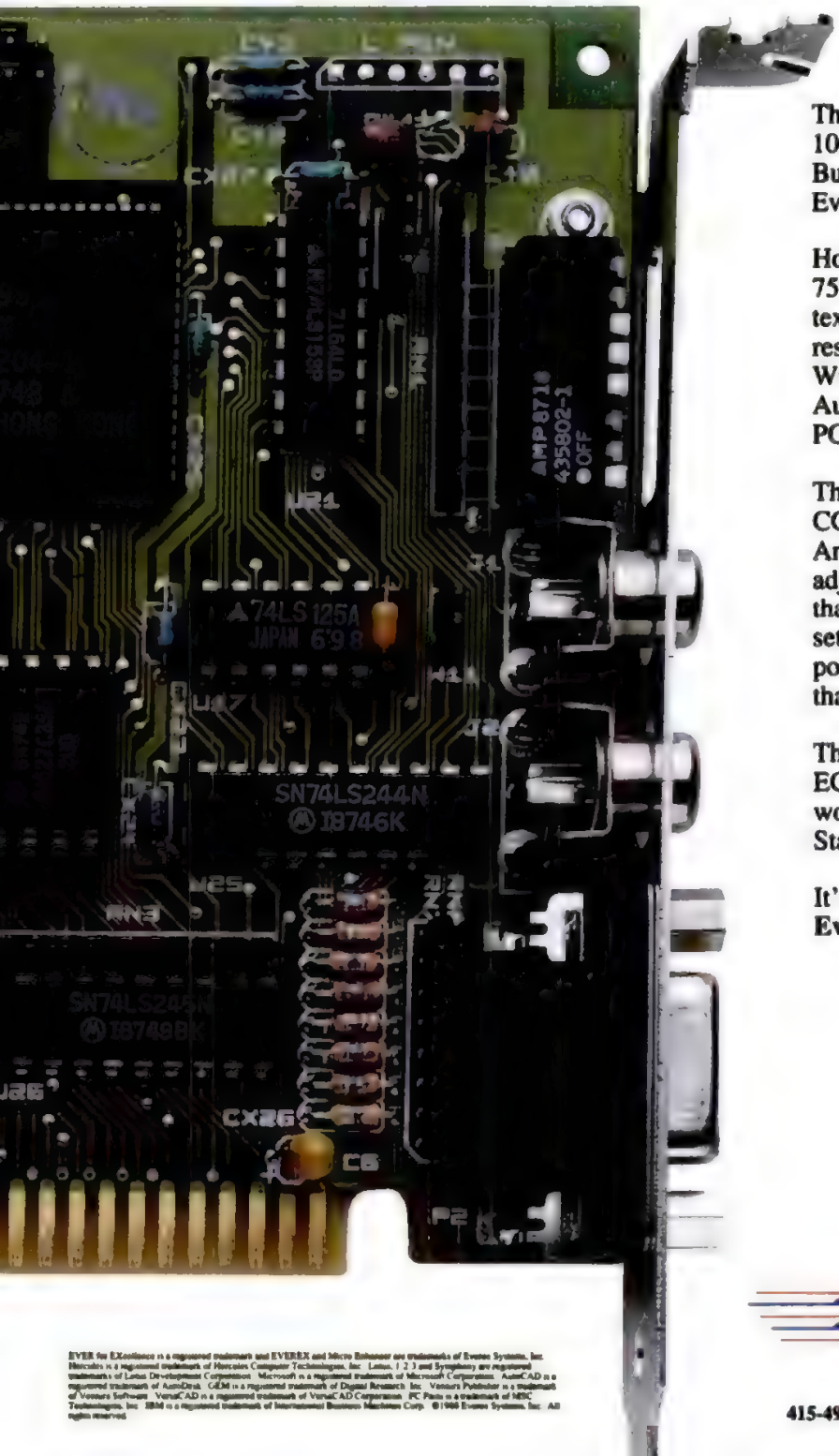

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mands described in the *Relay* reference guide, but a much faster way is to use the learn facility that comes with the program. A typical log-on session is recorded by *Relay* and saved as a script to be used on all subsequent calls to the same computer.

SOPHISTICATED EDITOR *Relay* makes it very easy to alter or fine-tune a log-on script. A sophisticated full-screen text editor may be used to edit scripts or any other DOS ASCII file. The editor can perform conventional block operations and has wildcard search-and-replace capabilities. Several files may be opened simultaneously for editing, and the editor may be used while *Relay* is on-line and transferring files to another computer.

The commands used in a typical log-on script are only a subset of those available to the user. *Relay*'s script language offers an extensive set of tools for handling the real-time factors inherent in data communications. As with many high-level languages, the basic programming elements consist of variables, functions, and commands.

System variables available to the pro-

PC MAGAZINE FACT FILE

VM Personal Computing Inc.
41 Kenosia Ave.
Danbury, CT 06810
(800) 84-RELAY
(203) 798-3800

***Relay Gold*, Version 2.0**
List Price: $250
Requires: 192K RAM, two disk drives, DOS 2.0 or later.

CIRCLE 684 ON READER SERVICE CARD

***Relay Silver*, Version 1.0**
List Price: $150
Requires: 192K RAM, two disk drives, DOS 2.0 or later.
In Short: Identical except for *Relay Gold*'s micro-to-mainframe links, these programs combine conventional terminal emulation and file transfer abilities with multitasking and text-editing features. Sophisticated but friendly to novices. Not copy protected.

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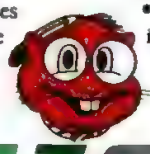

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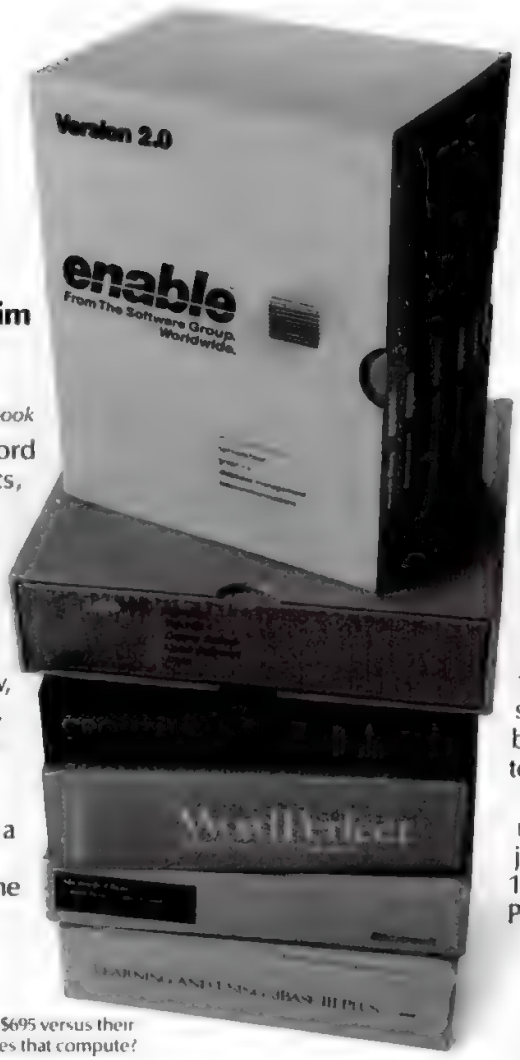

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PC Magazine

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grammer include things like current date and time, line quality, and DOS file identifiers for files being manipulated by *Relay* at any given moment. Functions perform simple calculations, handle string manipulation, and supply certain kinds of hardware information. A variety of date and time conversion functions are also included in the program.

Script-language commands initiate various *Relay* activities and handle branching based on certain conditions. Commands can display messages on the user's screen and can pause for keyboard response. They are used for dialing and answering calls, as well as exchanging messages and files with other computers.

Status information on the success or failure of a command is reported, and a script may respond appropriately, using the familar if-then-else construct. Commands such as On Error and On Disconnect, which tell the program what to do if it detects an error or a disconnect message, are set to poll for specific conditions at all times. Any script can transfer control to another, and GOTO and GOSUB commands may be used to branch within a script.

DOS programs or commands may be run from within a *Relay* script. Programs run concurrently with any printing or file transfer that may be going on. The *Relay* editor may also be accessed by scripts, so files can be downloaded, processed in the editor (sorted, for instance), and then saved to disk. *Relay*'s impressive concurrent capabilities are always available no matter whether a script is running.

■ If what you need is a comprehensive, powerful program, you'll delight in *Relay*'s many options.

PASSWORD PROTECTION *Relay* may be set to receive calls from other computers running a version of *Relay*. Remote file transfers can take place with the sending computer transferring a file to an unattended receiving computer. The caller may perform most DOS functions and even run programs on the remote machine, though the display output is not echoed to the calling computer. Three types of password protection are available to prevent unauthorized access to the host PC.

If you need a comprehensive, powerful communications program, you'll delight in the many options *Relay* puts at your disposal.—**David L. Hoffman**

Respond/Async

Menu lovers will fall head over heels for Software Synergy's *Respond/Async*. Priced at $129, it tries to please everyone—from beginners to programmers. Its Quick Start mode lets beginners use a few keystokes to connect to on-line services. Programmers will like the program's script language: it lets you write a series of program components, called dialogues, that you can save in command libraries to automate communications.

The program takes up about 500K of disk space, but you can reduce its bulk by deleting unwanted terminal emulation files. The 33-page Quick Start manual takes you through installation, start-up, communications profile configuration, and hookup quickly and fairly clearly. The manual has no tutorial, but introductory sections walk you through the usual operations. On-line help is available.

HEAVY ON MENUS *Respond/Async* is entirely menu-driven. Using what Software Synergy calls *Xpress* keys, you can jump to the program's major function screens. You can exit to DOS without breaking communications and run other programs from *Respond/Async* by defining "program profiles." Menu-weary users can write dialogues to automate command sequences or type successive menu commands quickly to move through the screens without pausing.

There is an Unattended mode through which you can set up your machine so that you or anyone else who supplies the specified password can operate it from a remote location.

Respond/Async's terminal emulation shines. In defining a terminal profile, you can select from screens of options that use

Respond/Async's *script language uses dialogues, or program components, to automate command sequences; the above dialogue contains commands for signing on to MCI Mail. Stored in a library, a dialogue can include up to 13 lines of commands.*

How to pick th

Good instincts run in this family (left to right): the new LOGITECH HiREZ Mouse ($179), the only mouse designed expressly for high-res screens; the LOGITECH Series 2 Mouse for the IBM PS/2 ($99, plugs right into mouse port); and the LOGITECH Mouse for standard screens ($119, in bus and serial versions).

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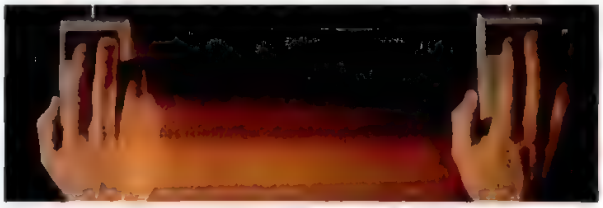

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***Respond/Async*, Version 4.19**
Software Synergy Inc.
641 Avenue of the Americas
New York, NY 10011
(212) 645-9663
List Price: $129
Requires: 256K RAM, DOS 2.0 or later.
In Short: A menu-driven program with a Quick Start feature that eases operations for beginners. Menus can become tedious, and circumventing them requires work. The script language works with other features to give total control over communications processes. Not copy protected.

the same definitions as those used in the emulated terminal's documentation. The advantage is that the terminology is familiar to people who use the specific terminals supported.

Respond/Async also offers complete emulation of the terminals it supports. Terminal emulation is less important for those who communicate only with other PCs or with major on-line services, but it's crucial for users who need to connect with computers or services that require specific terminals.

SCRIPT DIALOGUES Components of *Respond/Async*'s script language are called libraries and dialogues. A dialogue consists of up to 13 lines of commands. Dialogues are stored in libraries, with each library containing as many as 25 dialogues. You can create and save a total of 25 libraries. To create and edit dialogues, you must use *Respond/Async*, not another editor. *Respond/Async*'s dialogue commands can control variables, video display, data input and output, communications lines, telephone support, dialogue command flow, and error processing. Dialogues can call each other, and you can also chain them together.

Once you are familiar with using *Respond/Async*, its distinctive terminology may become second nature, but to novice users the program's references to libraries, directories, dialogues, and various types of profiles can be confusing.

Respond/Async is easy to use but has plenty of power features for advanced users.—**Bruce Brown**

SideTalk

Lattice's *SideTalk* is a $119 programmable communications program that can operate in the background or foreground. While basic operations are fairly straightforward, the program's script language, SideTalk Command Language (SCL), is a high-level language that facilitates powerful and fancy procedures. It's easy to create pop-up menus that include choices for command-driven functions.

To load the program on a hard disk, you put the system distribution disk or a backup in drive A:, make it the current drive, and type LOADST C:. *SideTalk* creates its own subdirectory on your hard disk, \ST, and copies all necessary files into it. You can use *SideTalk* with a floppy-disk-only system, but a hard disk drive is recommended if you're going to use the program in its RAM-resident, background mode. It works with any modem with a configuration file written with SCL. The default configuration works for modems that are fully Hayes compatible.

In addition to a 52-page user manual, the documentation includes more than 100 pages of appendixes, most of which provide excellent descriptions of the SCL commands—including a definition of the syntax and all option flags, a complete description of the command operation and flags, one or more appropriate examples, and a "See Also" cross-reference to other relevant commands or chapters in the manual. It's easy to find what you need without being overwhelmed by lengthy, convoluted explanations.

There is no tutorial. Users who turn to this program should be just a notch above novice status. And for them the excellent program design and clear manual make the need for a tutorial program redundant.

Support is abundant. In addition to their customer support department, Lattice maintains an electronic bulletin board where you will find tips on using the program, public domain software you can download, and a forum through which you can chat with Lattice staff or with other users. Although there is a predefined phone

SideTalk's initial screen displays a status line and several Alt-key commands you can use while in terminal mode. F10 invokes the pop-up menu that helps you set parameters, build a phone directory, and make calls.

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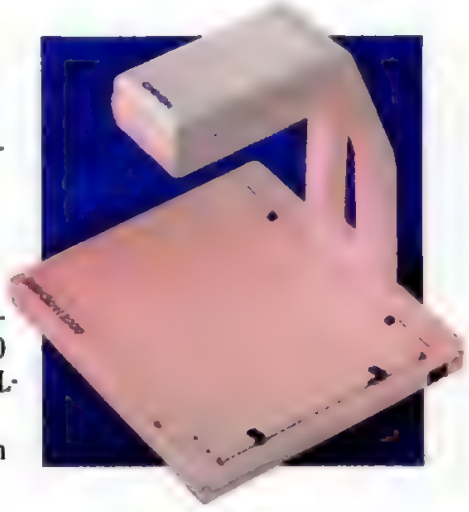

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***SideTalk*, Version 1.0**
Lattice Inc.
2500 S. Highland Ave.
Lombard, IL 60148
(800) 533-3577
(312) 916-1600
List Price: $119.95
Requires: 128K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: Able to run in the background and transfer files while other DOS applications are running, *SideTalk* gets high marks for raw power. Though not the best for novices, it has a complete script programming language and lets DP managers easily develop user menus. Not copy protected.

CIRCLE 682 ON READER SERVICE CARD

directory listing in *SideTalk* for the LATTICE-BBS, the company has moved and the phone number is no longer valid. The new address and phone numbers are included on an announcement in the manual, and you can edit the LATTICE BBS listing in the phone directory.

SideTalk uses function keys, single-key-selection menus, Alt-key combinations, "point-and-shoot" menus, and a plain command line. It would be easy to lose control with such a multifaceted design, but Lattice kept it together. You will not find menus for every possible function, just the simpler ones. When you master the program and want to work faster, you can go to the command line (Alt-C) and type commands directly. Once you decide it's time to customize the system or to set up some fancy procedures, then you enter a programmer's world and use SCL.

You use the "ST" command to load *SideTalk* into RAM-resident mode and "ST/N" to run it as a standalone product. The program comes up in terminal mode, so you can type directly to the modem at that point. A list of Alt-key commands, resembling a menu, is displayed on the screen.

BACKGROUND POWER You can use most any program when *SideTalk* is operating in the background. Some activities, such as a long recalculation in a spreadsheet, might suspend *SideTalk's* activities, however. When *SideTalk* finishes downloading a file in the background, it beeps several times. At that point you can call the program up, issue more commands, or go off-line.

Lattice is best known for its C compilers, and the SideTalk Command Language doesn't disappoint. It provides a powerful set of commands that allow you to automate any communications process. The more-advanced uses of SCL will need an editor to create a command file. Unfortunately one is not provided.

SCL command files can be as simple as lists of acceptable *SideTalk* commands, similar to a DOS batch file. But with labels for subroutines, SCL files can use conditionals and be programmed to wait for specific times to carry out tasks independently. You can also use the SCL language to develop new menu systems. The language includes variables, string handling, error handling, file control (up to three files open at once), input and output commands, arithmetic functions, program flow control, and window operations.

SideTalk does simple tasks easily, but there are other, lower-end products that are cheaper and easier. *SideTalk* stands out for the power users who want to roll their own. For $119.95, they can't go wrong; *SideTalk* delivers without overwhelming.—**Bruce Brown**

Smartcom III

Hayes Microcomputer Products, leader in the modem market, has introduced a new communications program, *Smartcom III*. This $249 program is more than an upgrade of Hayes's earlier *Smartcom II* communications software, which is still available. Unlike *Smartcom II*, which has different error-correcting protocols, a different user interface, and no script language, *Smartcom III* is very versatile.

Smartcom III requires FILES=20 on your CONFIG.SYS file. It seeks confirmation from you, however, before automatically creating or modifying your CONFIG.SYS file.

The program is set to work with Hayes modems—either the older style or the new V-Series. There are no provisions to modify modem setup or initialization strings. Since it knows how to configure Hayes modems, there's no discussion of DTR, CD, and other RS-232 lines. *Smartcom III* will work with a three-line connection, but it can make use of more-complex connections if available. Setting the duration of the dialing tones and enabling the V-Series hardware error checking is about all the adjustments you will have to make. If you have a Hayes modem, there's no problem, but the program isn't guaranteed to work with anything else. So-called Hayes compatibility in other modems can be something less than total.

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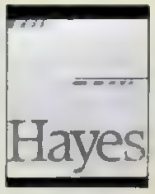

***Smartcom III*, Version 1.0b**
Hayes Microcomputer Products Inc.
705 Westech Dr.
Norcross, GA 30092
(404) 441-1617
List Price: $249
Requires: 512K RAM (640K recommended); two 720K floppy disk drives (hard disk strongly recommended); DOS 2.0 or later.
In Short: *Smartcom III* is designed for the new generation of machines. Although its high RAM and disk memory requirements make it the wrong choice for a floppy disk system, power users looking for an easy-to-use yet extremely sophisticated program will find it offers both. Not copy protected.

CIRCLE 681 ON READER SERVICE CARD

DIFFERENT TERMINOLOGY *Smartcom III* uses unique terminology. The settings that define the nature of the contact are called Activities and Connections. Activities settings control such elements as the screen display and printer setup, how files are to be transferred, execution of scripts, and the like. Connections settings adjust such functions as bit-per-second rate, direct versus modem connections, modem control settings, and so on.

Generally, you first create an Activity for each service, bulletin board, or other computer system with which you communicate, then choose which Connection you want to use. A variety of activities and connections are included.

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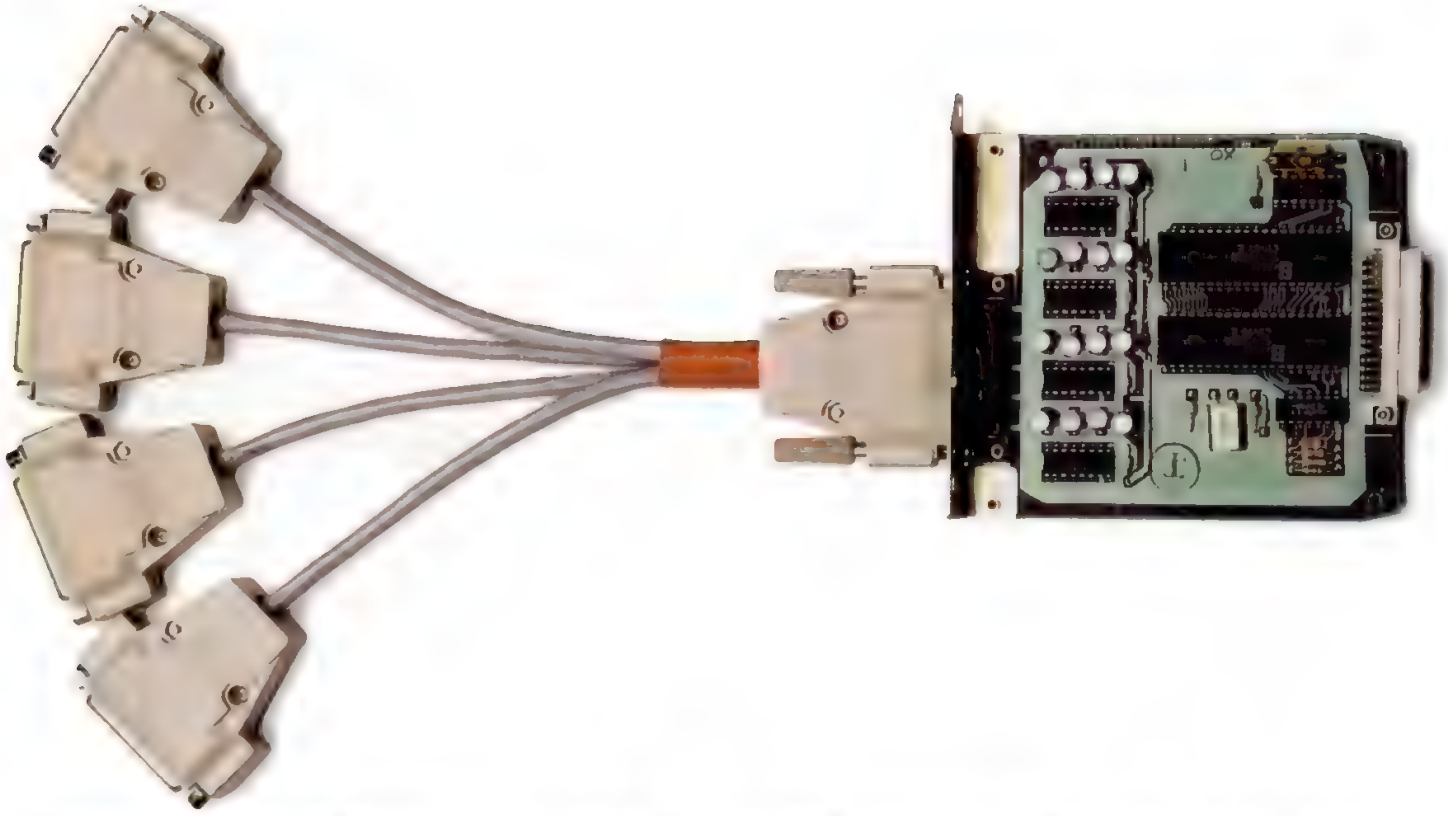

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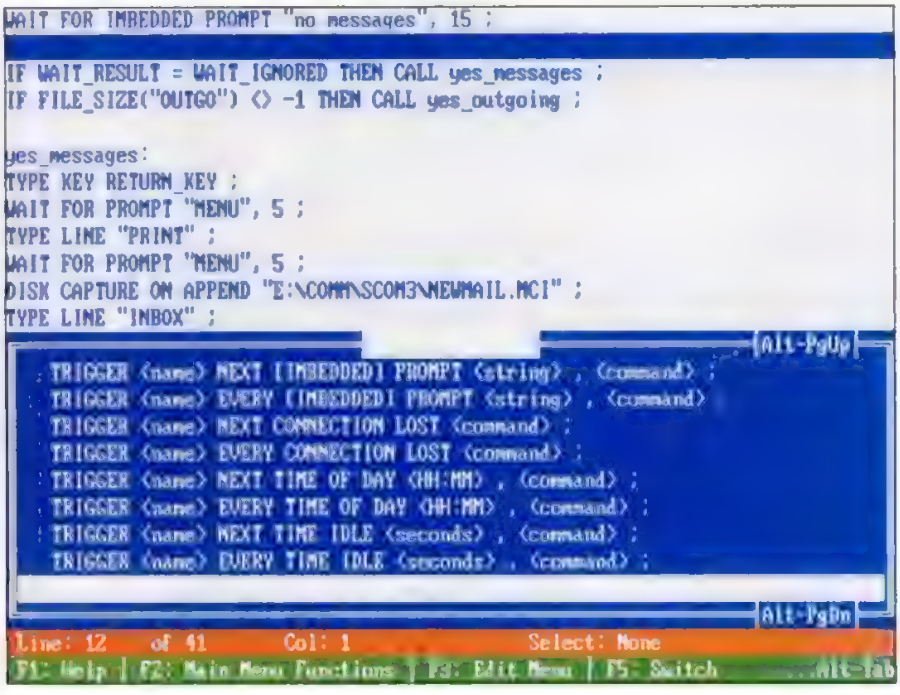


Smartcom III's split-screen editor lets you enter long commands into scripts by pointing and choosing. This process, which indicates where to place prompt messages and variable names or filenames, saves time and reduces typing errors.

Smartcom III's user interface is completely textual but intuitive and logical. You don't miss the graphics at all. It uses a combination of menu styles and window frames suitable to communications.

USING THE LANGUAGE There is a comprehensive, well-written, context-sensitive help system. Moreover, *Smartcom III* has a fine text editor that you can use for composing messages or for writing scripts.

When you write scripts, a window appears that contains all the language's statements. It lists the statements alphabetically or in functional order, according to your choice. When you select one, it appears in your script and indicates where you need to place prompt messages, variable names or filenames, and the like. This cuts down on typing and reduces errors.

Smartcom III's SCOPE (Simple COmmunication Programming Environment) language is powerful, flexible, and reasonably easy to learn. The language is not as structured as modern BASICs, so you have to use lots of GOTOs to control program flow, and the syntax is rather wordy. Scripts are compiled for faster execution; the compiler checks for errors, inserts descriptive error messages, and returns you to the editor if necessary—an excellent and helpful system. SCOPE is unquestionably potent and could be used to program a bulletin board system or even games.

Smartcom III supports various permutations of Xmodem, Ymodem, and Kermit file protocols. Interestingly, Hayes's own Verification protocol introduced in *Smartcom II* is not supported (Hayes felt that the 1K-block Ymodem protocols outperformed the 512-byte Verification protocol). The CompuServe-B protocol isn't supported either—a disappointment to fans of that popular service.

SCRIPTS FOR REMOTE *Smartcom III* supplies a script for remote file transfer. Basically, this is a simple BBS that gives you the ability to download or upload files with Xmodem, Xmodem (checksum), Xmodem 1K, Ymodem-G, or Kermit. The script also requires the equivalent of many DOS commands, but you cannot execute programs on the remote system. The script includes password protection, though you might want to add multiple password levels. If you prefer, you can simply use the Kermit screen to manage file transfers, with the remote computer acting as a Kermit master.

Smartcom III does allow you to drop to DOS locally while maintaining your connection, enabling, say, a long download to continue in the background. Hayes categorizes this feature as "undocumented" and discusses it only in a READ.ME file on-disk. The company warns of possible incompatibilities, and you may have to adjust some environment variables to juggle memory allocation, but it worked well in our tests.

Smartcom III's panoply of features takes a heavy toll on system memory. *Smartcom III* requires 512K of RAM, and 640K is desirable. Say good-bye to memory-resident software. Anything other than a full quota of memory in your machine precludes using the program. In fact, Hayes strongly recommends a hard disk. You can shoehorn *Smartcom III* onto a portable with two 720K floppy disks, but it's a tight and uncomfortable fit. The slow floppies on most portables don't help either when loading the large modules.

Smartcom III may not be the best choice if you want one program to run in all environments and on all machines. It's big and bulky, but these days serious PC users have hard disks and lots of RAM. *Smartcom III*'s script language, however, is advanced and versatile. *Smartcom III* will be attractive to those using Hayes modems, and it may be something to consider purchasing if you're certain your non-Hayes modem is completely Hayes compatible.—**Glenn A. Hart**

■ *Smartcom III*'s panoply of features takes a heavy toll on system memory, but its script language is advanced and versatile.

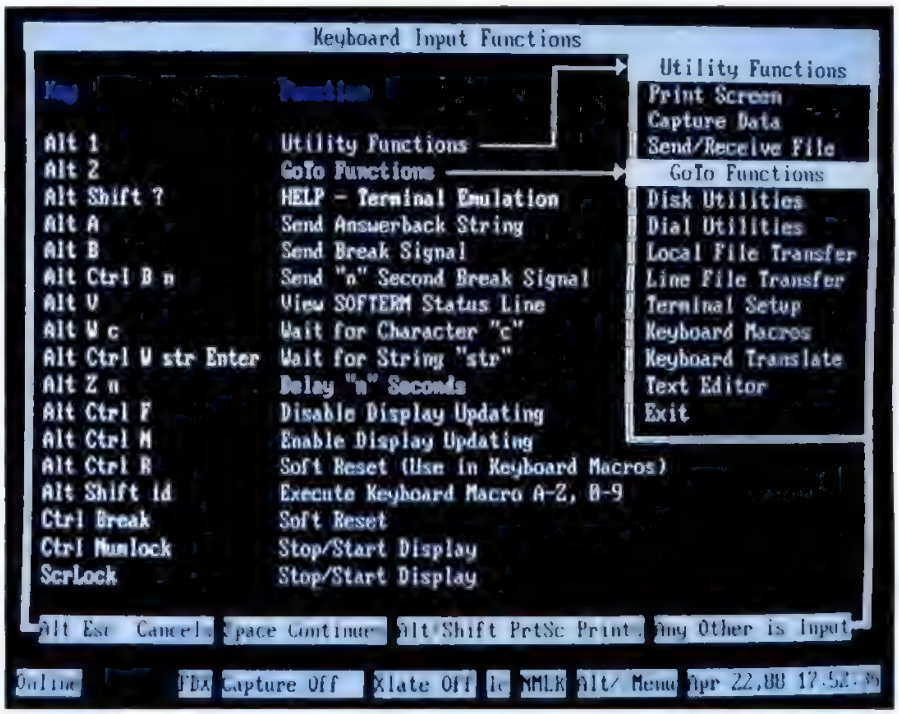
Softerm

Softerm, a $195 industrial-strength communications program from Softronics, has enough features to delight the most jaded PC user. It's not the sort of program you'd fire up on Friday nights to retrieve stock quotes—that would be like flying the Concorde across town. But you would turn to it if your boss asked you to write a bulletin-board system.

If all *Softerm*'s goodies (including terminal emulations, background communications, a full complement of script commands, queue management, and support for multiple operating systems) give you the impression that it also requires considerable time to learn, you're right. It can take weeks to master all the program's features. But installing *Softerm* is easy if you use one of the 23 supported modems.

EXTENSIVE EMULATION *Softerm* emulates almost every terminal on the market, including ADDS, Data General, DEC, Hazeltine, Hewlett-Packard, Honeywell, IBM, Lear Siegler, Perkin-Elmer, TeleVideo, and, of course, the ubiquitous dumb terminal.

After you've used *Softerm* for a few days, its menu-driven interface becomes more of an annoyance than a help. To disconnect from a call, for example, you use the Alt-2 combination to bring up the GOTO menu, then press F2 to pop up the Dial Utility menu, move the cursor to select the Hangup option, press Enter, and then use the Alt-Esc combination to return. Even with practice, this procedure takes time. To help you cope, Softronics blessed *Softerm* with the ability to accept keyboard macros. No keyboard macros come with the program, but the user's manual gives you several examples of how to create them.



Softerm's menu-driven interface helps new users wade through the myriad options offered by the program, but more-proficient users will want to develop macros to save time.

TSR VERSION You can also install *Softerm* in an abbreviated TSR version, called the Communications Agent. This version can send and receive files in the background while you run conventional programs in the foreground. It does not conflict with other popular TSR software such as *SideKick*.

A queue manager allows you to put up to 128 tasks in the communications queue at one time, and to fire them off consecutively or in unattended operation by date and time. The queue manager also controls multiple COM ports, so you can be exchanging files with four sources at the same time.

The Communications Agent enables *Softerm* to offer the File Agent, such a clever and simple option that it deserves an award. Here's how it works. You assign the communications port a device letter, similar to that of a disk drive—*L*, for example. Then, to download a file, all you have to do is issue a DOS COPY command, such as COPY L:WEEKLY.DAT

■ The Communications Agent enables *Softerm* to offer the File Agent, such a clever and simple option that it deserves an award.

PC MAGAZINE FACT FILE

Softerm, Version 2.10.01
Softronics Inc
7899 Lexington Dr.
#210
Colorado Springs, CO
80920
(800) 225-8590
(303) 593-9540
List Price: $195
Requires: 256K RAM, DOS 2.1 or later.
In Short: Since it's everything you ever wanted in a communications program and more, this sophisticated package is relatively difficult to use. If you take the time to learn its capabilities—background communications, a complete script facility, emulation for more than 30 terminals, queue management, and support for multiple operating systems—your effort at fluency is paid off in spades. Not copy protected.

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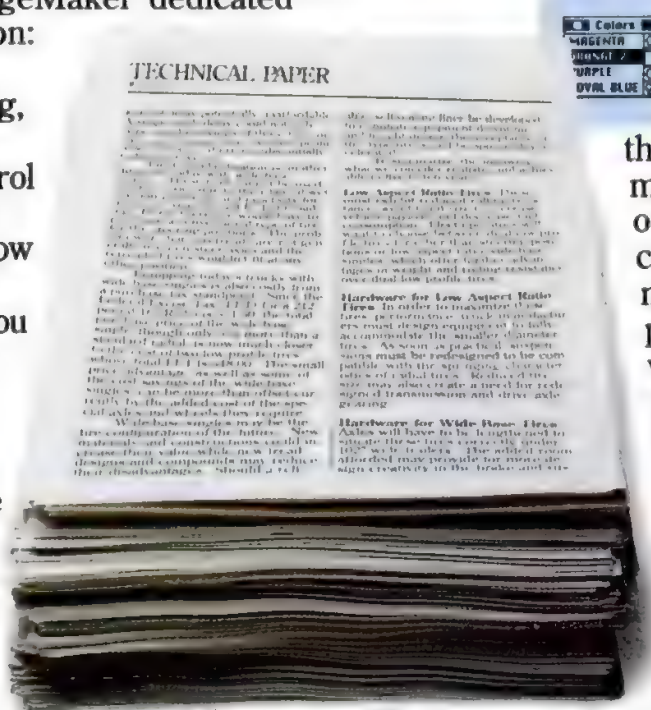

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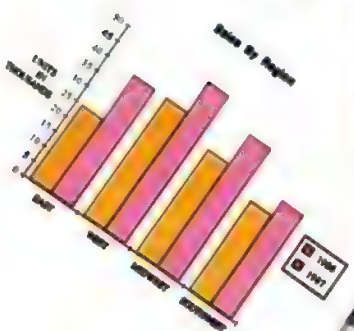

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Our new text wrap function gives you the choice of flowing text through an object, jumping over it or wrapping around it, like you see here.

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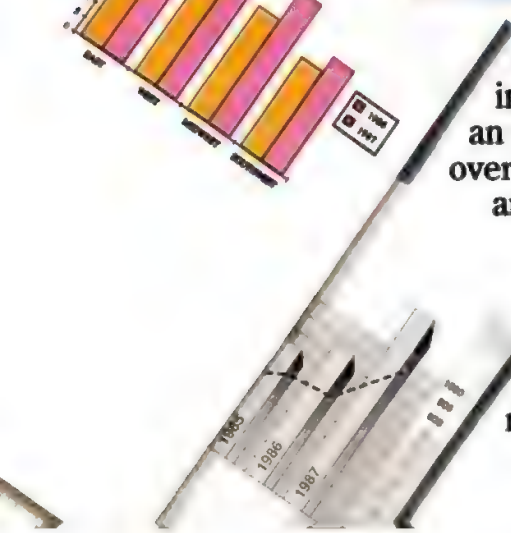

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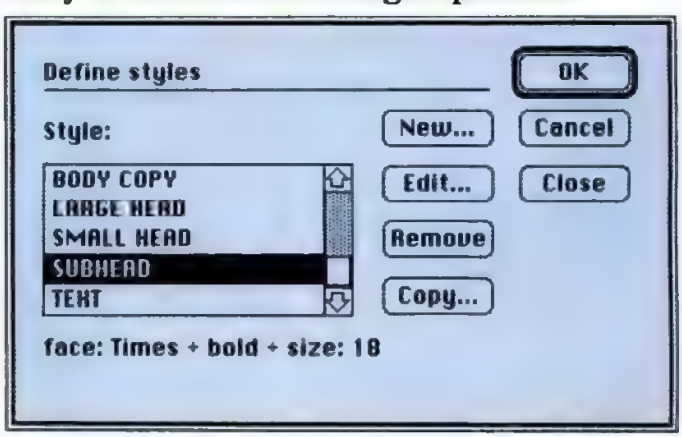

Is Turning 3.0

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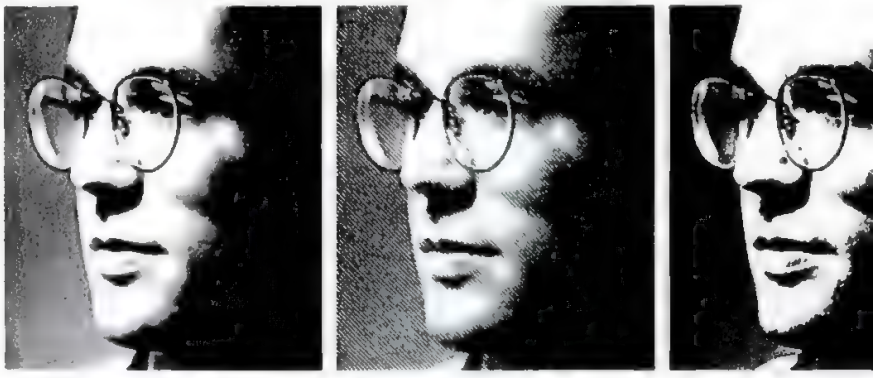

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■ COMMUNICATIONS SOFTWARE

EDITOR'S CHOICE

- **HyperAccess**
- **ProComm/ProComm Plus**
- **Smartcom III**

If you need a high degree of programming control or simply want the biggest and best, any program with a new-generation script language will serve your needs. However, Hayes Microcomputer Products' Smartcom III *stands out for its innovative approach to communications and script language development, and for its straightforward menu system. The program's size (it requires more than 1MB disk space and 512K RAM) makes it unsuitable for anything less than a 286 machine with a fast hard disk. Yet, as reviewer Glenn Hart points out, that (and $249) is merely the price you have to pay for using a program that advances the state of the art.*

Among programs with advanced script languages, Hilgraeve's HyperAccess, *IBM PC Revision 3.25 ($149), is the winner. Not only does its script language border on new-generation capabilites, but the program is easy to learn and use, and it offers the fastest file transfer we measured—both with the proprietary* HyperProtocol *and with the garden variety Xmodem. Any of these features would be worthy of note. Together they make a package that is hard to beat.*

For those whose script language needs are minimal and whose communications needs are casual, Datastorm's ProComm, *for a suggested contribution of $50, or* ProComm Plus, *at $75, is the clear choice. Speed of file transfer is on the slow side for both versions of* ProComm. *But for casual users, the mostly mnemonic commands are easy to learn and remember, the script language is adequate, and added features—like the host mode—are invaluable if you need them.*

C:*.*. The File Agent copies the file from device L: (actually the remote computer) to your hard disk. It does so by intercepting all DOS file calls and executing a script file to import or export the named file. Anywhere you can use a filename, you can use the File Agent.

Both the Communications Agent and the File Agent require you to use a comprehensive script language to control their operations, and *Softerm* provides it. The script language is sufficiently powerful to program a four-port bulletin board running in the background, and for $50 Softronics will sell you the script file it has developed to do just that. The script files included in the package are for routine tasks like logging on to The Source and CompuServe. Learning the language is not easy, but the manual includes examples, and Softronics maintains a telephone hot line that is staffed by knowledgeable people.

Softerm is not without flaws. The layout of the file-transfer screen is poor; introducing color and graphics would help separate the status information from the display of the data being transferred. And since the phonebook dialer is case sensitive, you must remember exactly how you entered a name if you want to find it quickly. Also, the dialer waits 45 seconds before redialing a busy number, and you cannot change that parameter.

Because *Softerm* has so many commands and Alt-key combinations, learning to use it takes a lot of patience and some time. Nevertheless, the program certainly rewards your efforts, with extensive emulations, background communications, a complete script facility, queue management, and support for multiple operating systems.—**Donald B. Trivette** PC

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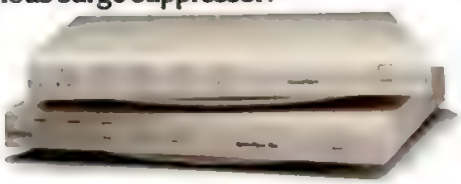

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- Clock Calendar w/Battery
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- Operations Documentation
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- 1.2MB Floppy Disk Drive
- 8 Expansion Slots
- Operations Documentation
- One Year Warranty

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The St. Louis Arch

Arche Rival 386™ Personal Computer
The Arc de Triomphe de L'Étoile

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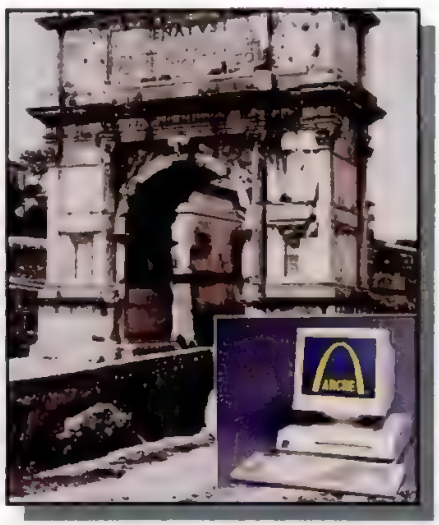

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CIRCLE 111 ON READER SERVICE CARD

THE NICHE FACTOR

NINE ATs COMPETE FOR MARKET SHARE

Demand for AT compatibles is stronger than ever, and manufacturers are jockeying for position in the market. The latest machines reviewed here are from Amdek, American Mitac, Arche Technologies, Core, Dataworld, Epson, Hyundai, Kaypro, and Star Industries.

Now that there is a general consensus that the standard base system for business computing in the next several years is going to be an 80286-based AT compatible running between 8 and 12 MHz, complete with 1 or 2MB of RAM (more when OS/2 applications are available) and a hard disk of at least 20MB, manufacturers of AT compatibles are competing for individual niches, following the age-old business adage that a small slice of a big market is just as good as total control of a small market.

For the computer buyer, price is no longer a barrier to AT-level performance. When *PC Magazine* evaluated 21 286-based systems configured with monochrome monitors and hard disks with total price tags under $2,000 ("The Cheapest ATs Ever," *PC Magazine*, February 16, 1988), we found that although quality and features varied significantly from machine to machine, over half of the systems were perfectly legitimate choices. And even the scrawniest one of the bunch could outperform an XT by a factor of two.

Prices of AT-compatible systems still cover a wide spectrum, however. Famous-name manufacturers like NEC, Epson, Leading Edge, and NCR can (and do) ask more for a 286 system than a big mail-order house like CompuAdd does. What you pay for is a comfortable measure of confidence: the known quality of a known quantity. But now that dozens of systems can be

AT Compatibles: Summary of Features

(Products listed in ascending price order)

	Star Industries AT 286	Core ATomizer	Hyundai Super-286C	Epson Equity II Plus	Dataworld Data 286	Arche Rival 286
BASIC CONFIGURATION						
Price	$895	$1,350	$1,499	$1,595	$1,605	$1,795
RAM	512K	512K	640K	640K	512K	640K
Floppy disk drives	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB
Hard disk	None	None	None	None	None	None
Clock/calendar	●	●	●	●	●	●
Software	*PC-Write*	DOS 3.2 or Xenix; backup utilities	DOS 3.2; setup	DOS 3.2; diagnostics, GW-BASIC, *SpeedStor*	Setup	DOS 3.3
Monitor	None	None	None	None	12-inch EGA	14-inch monochrome
Ports	1 parallel	1 parallel, 1 serial	1 parallel, 2 serial	1 parallel, 1 serial	1 parallel	1 parallel, 2 serial
Slots	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	4 16-bit, 2 8-bit	3 16-bit, 3 8-bit	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit
Power supply (watts)	200	200	135	140	200	200
Reset switch	●	●	○	●	●	●
Keyboard style	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced
CONFIGURATION TESTED						
Price	$1,273	$2,826	$2,249	$3,643	$2,439	$2,195
Configuration	30MB hard disk, monochrome monitor	40MB hard disk, EGA monitor	30MB hard disk, monochrome monitor	40MB hard disk, EGA monitor	1MB RAM, 40MB hard disk, EGA monitor	20MB hard disk, monochrome monitor
SPECIFICATIONS						
Clock speed (MHz)	8/10	6/8/12	8/10	8/10	8/12	8/12
Controller card handles	2 floppy, 2 hard disk drives	2 floppy, 2 hard disk drives	2 floppy, 1 hard disk drive	2 floppy, 2 hard disk drives	2 floppy, 2 hard disk drives	2 floppy, 2 hard disk drives
OTHER						
Alternative disk drives	None	None	None	720K 3½-inch*; 360K 5¼-inch*	720K 3½-inch*	None
Warranty	1 year	1 year	18 months	1 year	1 year	2 years
BIOS manufacturer	Award Software	Phoenix	Award Software	Epson	Phoenix	Award Software
FCC certification class	B	B	B	B	B	B

—Indicates Editor's Choice ●—Yes ○—No *Optional †Standard

found south of the $2,500 border, the big-name companies have had to take a hard look at their pricing structures. These days, a little shopping may lead you to a name-brand system discounted up to 30 percent. How else can such companies compete with machines like the 21 we recently reviewed, whose average configured price was about $1,600?

WINNING WITH ORIGINALITY As price distinctions blur, buyers look to features to find differences between systems, and this is where the niche factor comes into play. One trend is the reemergence of backplane designs, which hark back to the good old days of CP/M machines when wide-open architecture was the name of the game. The TeleVideo Open Architecture Solution series, the new Kaypro 286, and the Amdek System 286A represent three examples of the backplane design. (The Kaypro and Amdek machines are reviewed here.)

Why do it? By putting the vital chips on expansion cards rather than on the motherboard, the box is theoretically immunized against obsolescence. When your desire

Amdek System 286A	Kaypro 286	Mitac Paragon 286F
$2,495	$2,995	$3,495
1MB	1MB	1MB
One 1.2MB	One 1.2MB	One 1.2MB
None	40MB	40MB
●	●	●
DOS 3.2; GW-BASIC, disk caching, other utilities	DOS 3.2; GW-BASIC, *SpeedStor*, *WordFinder*, *WordStar* 4.0	DOS 3.2; *Disk Manager*
None	12-inch monochrome	12-inch EGA
1 parallel, 1 serial	1 parallel, 1 serial	1 parallel, 2 serial
5 16-bit, 2 8-bit	2 16-bit, 3 8-bit, 4 for system	4 16-bit, 1 8-bit
190	160	145
○	●	●
IBM Enhanced	IBM Enhanced	IBM Enhanced
$4,740	$2,995	$3,495
40MB hard disk, EGA monitor	40MB hard disk, monochrome monitor	40MB hard disk, EGA monitor
8 12 5	6/12	8/12
2 floppy, 2 hard disk drives	2 floppy, 2 hard disk drives	2 floppy, 1 hard disk drive
None	None	720K 3½-inch†
1 year	1 year	1 year
Phoenix	Phoenix	Phoenix
B	B	A

for a 386 processor becomes unbearable, you'll just buy one on a card and swap it into a slot.

Do you care about the size of your system? Some people would pay any price to get that big AT box (21 inches wide) off their desk. Many recently introduced AT compatibles let you do that; machines reviewed here from Amdek, American Mitac, Arche, Epson, Hyundai, and Star Industries are good examples. One note of caution: designers of smaller system units have two methods of achieving their slim-down goals—by cutting out drive bays or cutting out expansion slots. You should make sure that the small-footprint machine that has caught your eye will accommodate all the devices you need. One way small-footprint manufacturers can compensate for a dearth of slots is to install a well-designed motherboard that can provide many of the functions normally assigned to slot-hungry multifunction cards (memory expansion, parallel and serial ports).

SPEED MACHINES The year 1988 has seen the introduction of souped-up versions of older AT favorites. The Epson Equity III Plus, for example, has been revamped and now runs at a top speed of 12 MHz, up from 8 in the original model. Speed is always an advantage—at least until you run into a small attack of software incompatibility. This is less of a problem than it was a year ago ("High-Speed ATs: Life in the Fast Lane," *PC Magazine*, April 14, 1987), but it's important to choose a machine that can be throttled down, either by an external switch or a set-up program, when the need arises.

Reviews of nine new AT-compatible systems follow. They are the most recent arrivals to PC Labs, and they represent a good cross section of the market as it exists today. The cheapest—the Star Industries AT 286—is $1,273 configured with hard disk and monitor; the most expensive—the Amdek System 286A—is over $4,500 fully configured. There are names you know (Epson, Kaypro, Core) and names you may never have heard before (Mitac International is a Taiwan-based manufacturer, and Arche Technologies is a division of Pro-Kennex, the tennis racket people). Rounding out the group are a new machine from Korean giant Hyundai and a mail-order bargain from Dataworld. In the near future we will review two more new competitors who are joining the fray—the Leading Edge Model D2 and the PC's Limited System 200.

Shopping for an AT compatible is more complicated than ever, but having a wide range of machines to choose from means you're that much more likely to find the system that's perfect for your needs and your budget. Reviews follow in alphabetical order by manufacturer's name.

—Donald P. Willmott

AMDEK CORP.

Amdek System 286A

The Amdek System 286A is a classy, fast, and upgradable small-footprint AT-compatible machine. From its 16-character LCD system unit display to its modular internal design, the 286A is pleasing to look at and a joy to use.

The 286A costs $2,495 and comes with 1MB of 80-nanosecond RAM, a Phoenix ROM BIOS for IBM compatibility, and a dual-speed 8- or 12.5-MHz clock. It flies along at zero wait states and achieved the fastest performance in benchmark testing of processor and memory speeds.

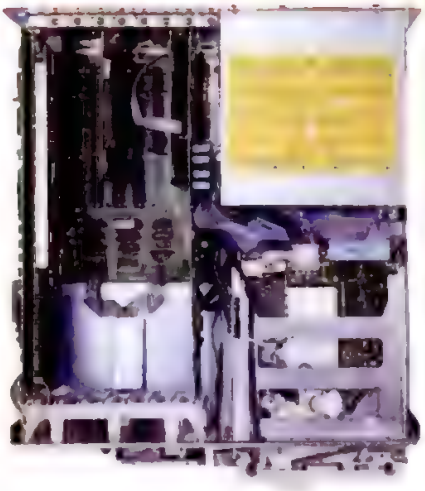
The 286A system box design is high-tech looking. It's 6½ inches high, only 15 inches wide, and a full 17 inches deep. You turn the machine on with a front-mounted power button and select system performance clock speed with a second front-panel button. The LCD tells you the time, date, and current operating speed. You can also toggle a performance indicator that uses a horizontal bar graph to display relative processor efficiency depending on the task at hand. The liquid crystal

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

Amdek System 286A
Amdek Corp
1901 Zanker Rd.
San Jose, CA 95112
(408) 436-8570
List Price: With 1MB RAM, one 1.2MB 5¼-inch floppy disk drive, DOS 3.2, $2,495; with 40MB hard disk, $3,595; monochrome monitor and card, $360; EGA monitor and card, $1,145.
In Short: Largely OEMed from its sibling, Wyse, the small-footprint System 286A is a high-quality, 12.5-MHz 80286 system with nice finish work and a fine 101-key keyboard. Modular motherboard allows for future upgrading without your having to buy a new machine. In this case, you do get what you pay for.
CIRCLE 683 ON READER SERVICE CARD

The most interesting feature of the neatly designed Amdek System 286A is its motherboard, or lack thereof. Because the processor and other essentials reside on an expansion card, future upgrades are not only possible but easy as well. The system is an Editor's Choice.



Photographs: Roberto Brosan

display isn't important to system performance itself, but it's a nice touch.

SETUP SOFTWARE The Amdek setup software uses a single screen display. All you need to do in order to configure your machine is to use the Enter key and the keyboard function keys. Preparing the 286A for use is made simple by a high-quality, 64-page installation and assembly manual. The system also includes disks and manuals for DOS 3.21 and GW-BASIC and three utility software packages: Diskcache, Help, and Diskpack.

You can install up to three half-height devices in the 286A. The evaluation unit came with a 1.2MB 5¼-inch floppy disk drive and a 28-millisecond CDC 40MB hard disk. The 190-watt power supply has three power leads for disk or tape drives.

The 286A's internal electronics are different from the norm. Many of the chips and much of the operational circuitry normally found on the motherboard are located on two vertically mounted boards that plug into the motherboard. The plug-in devices include both the system's CPU and RAM chips.

This setup, actually manufactured by Wyse Technology, uses the motherboard more as a bus in which to plug compatible devices than as the repository for the actual brains and chief operating devices of the computer. The major advantage to this modular design is the potential it affords for easy improvement: you can upgrade the system with a faster processor or different memory just by pulling out a board. Amdek currently has an 80386 board in the works that will plug into this system board. Pricing has not yet been set.

Standard equipment includes a combination floppy/hard disk controller, as well as one parallel and two serial ports. The 101 key keyboard supplied with the 286A is another piece of good news. It is manufactured by Wyse for Amdek and has tactile response, with good travel and a nice click. It's almost as good as the "real" IBM Enhanced keyboard.

Amdek uses the standard IBM workalike Phoenix ROM BIOS: in this case, Version 1.83. It easily passed the benchmark tests that are dependent on BIOS compatibility.

UPSCALE MACHINE The Amdek is definitely an upscale machine and is sold through a dealer network that also furnishes service and support. While the 286A is not as expensive as IBM or Compaq machines, it's on the high end of the price scale of most of the AT-class computers we've tested. With a reasonably fast 40MB hard disk and an EGA video board and monitor, the 286A lists for $4,740—that's $1,250 to $1,900 more than the prices of other similarly equipped

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Operating System...And You'll Pay.

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CIRCLE 393 ON READER SERVICE CARD

machines in this round of AT-type computer testing. But the 286A's class shows in both its design and performance, and the modular design could save you money later on system upgrades.—**Bruce Brown**

AMERICAN MITAC CORP.

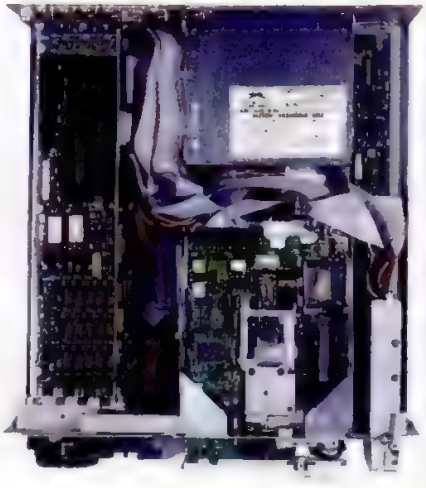
Mitac Paragon 286F

The small-footprint Mitac Paragon 286F, from American Mitac Corp., has the most expensive base price of the AT compatibles reviewed here, but it also has the largest number of standard features. For $3,495 you get 1MB RAM, two floppy disk drives, a 40MB hard disk, and an EGA monitor. Clearly, Mitac wants to be considered a one-stop shopping solution.

The most unique feature of the Paragon 286F is the vertical 3½-inch drive bay on the right-hand side of the machine. The 720K 3½-inch microfloppy disk drive that sits inside it is a standard feature (along with the customary 5¼-inch drive) and makes media transfer as easy as typing COPY A:*.* B:. Like IBM, Mitac is making a move toward the 3½-inch media standard. But, unlike IBM, it is doing it with low-density drives. A 1.44MB drive would have been a better choice.

SHRINK-WRAPPED Despite the small footprint (it's only 14¾ inches wide), the Paragon 286F does not skimp on features, though its mass storage capability is limit-

The Mitac Paragon 286F has a vertically mounted microfloppy disk drive to the right of its drive bays, giving it a unique appearance. The small-footprint package includes just five expansion slots, but all the vital ports, including video, are built into the motherboard.



FACT FILE

Mitac Paragon 286F
American Mitac Corp.
410 E. Plumeria
San Jose, CA 95134
(408) 432-1160
List Price: With 1MB RAM, one 1.2MB 5¼-inch floppy disk drive, one 720K 3½-inch floppy disk drive, 40MB hard disk, 12-inch EGA monitor and card, VGA controller on board, DOS 3.2, $3,495. Monochrome monitor and card, $119.
In Short: A high-quality 12-MHz 286 machine that comes with a hard disk and monitor included in the base price. The EGA monitor isn't great, but the rest of the system is top-notch, and the standard 3½-inch microfloppy disk drive is an extra advantage.

CIRCLE **676** ON READER SERVICE CARD

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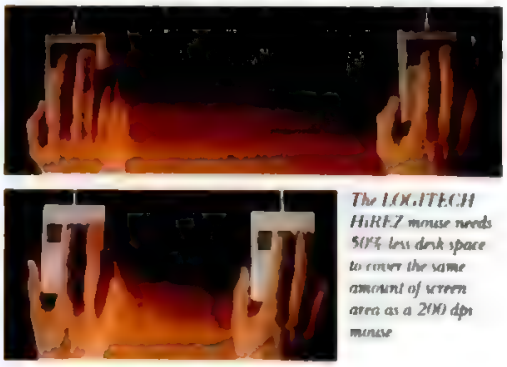

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LOGITECH

CIRCLE 182 ON READER SERVICE CARD

ed. There is room up front for two exposed half-height devices, as well as the vertically positioned microfloppy drive. All the bays were filled on the evaluation unit with standard equipment: a 1.2MB 5¼-inch floppy disk drive, a 40MB half-height hard disk, and the 720K microfloppy disk drive. Though the motherboard offers only five expansion slots (four 16-bit and one 8-bit) it compensates by offering two built-in serial ports, a parallel port, the floppy disk controller, and the enhanced EGA video port. The only slot that needs to be occupied to run the machine is the one holding the hard disk controller.

The front panel of the machine includes the drive bays, a lock, the on/off switch, a reset switch, and lights to indicate hard disk activity and 12-MHz turbo mode.

In microprocessor testing, the Paragon 286F performed on a par with other 12-MHz machines. Its 8-MHz operation was also without surprises. The 40MB Microscience hard disk that was installed in the Paragon 286F was an able performer and rated an average access time of 32 milliseconds in the hard disk benchmark tests. The Phoenix ROM BIOS ensures excellent compatibility.

The 12-inch EGA monitor included with the system produces good text, but the colors are hazy, lacking the vibrancy that EGA users demand. A switch below the screen allows the user to select green, amber, or white characters in text mode. Here is where the one-stop shopping solution stumbles. Getting ten pieces put into one system for one price is certainly an easy way to shop, but what if one of the pieces (a $500 piece in this case) is unacceptable?

KEYBOARD CONSIDERATIONS Since it plugs into the front of the computer and has an extra-long cord, the keyboard, which seems oversized when placed in front of the diminutive chassis, can be used far from the screen. It is of the standard 101-key IBM Enhanced-style design and has a soft touch with little audible feedback.

Standard software includes DOS 3.2 and its manuals and Ontrack's *Disk Manager*. A clear and well-illustrated user manual also comes with the system. Given the fact that a 40MB hard disk is standard, Mitac might want to consider including DOS 3.3 with the Paragon 286F so that disk partitioning is not necessary unless the user wants to do it. All Mitac machines come with a 1-year warranty.

The Mitac Paragon 286F is by no means a bargain machine, though its everything-for-one-price packaging makes the $3,495 price tag understandable. Mitac has positioned the system as a corporate solution, and it is but one member of a family of PCs that range from an XT-class machine all the way up to a 20-MHz 386-based PC. In the 80286 category, Mitac also offers the Paragon 286VE, a 16-MHz 286 machine priced $500 above the level of the Paragon 286F. Evaluation units were unavailable at the time of this review.

If you're operating with the kind of budget the Paragon 286F demands, the machine is worth a look. Mitac's attempt to distinguish itself by traveling the high-quality road in the AT-compatible market is, for the most part, successful.

—Donald P. Willmott

OUR REVIEWERS

Greg Alwang is a consultant at Soft Industries, an independent computer consulting firm based in Southington, Connecticut.

Bruce Brown is a principal of Soft Industries, an independent computer consulting firm based in Southington, Connecticut.

Jonathan Matzkin is a staff editor of *PC Magazine*.

Catherine D. Miller is an associate editor of *PC Magazine*.

Donald P. Willmott is an associate editor of *PC Magazine*.

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

Arche Rival 286
Arche Technologies
745 High St.
Westwood, MA 02090
(800) 422-4674
(617) 461-1111 (in Mass.)
List Price: With 640K RAM, one 1.2MB 5¼-inch floppy disk drive, 14-inch monochrome monitor and card, DOS 3.3, $1,795; with 1MB RAM, $1,995; with 20MB hard disk, $2,195, EGA monitor and card, $600
In Short: An aesthetically designed and solidly built 12-MHz 286 machine, the small-footprint Arche Rival 286 performs in the same range as do other machines in its class (with the exception of its slow, optional 70-millisecond hard disk). Its beautiful 14-inch flat-screen monochrome monitor really sets it apart

CIRCLE 882 ON READER SERVICE CARD

ARCHE TECHNOLOGIES

Arche Rival 286

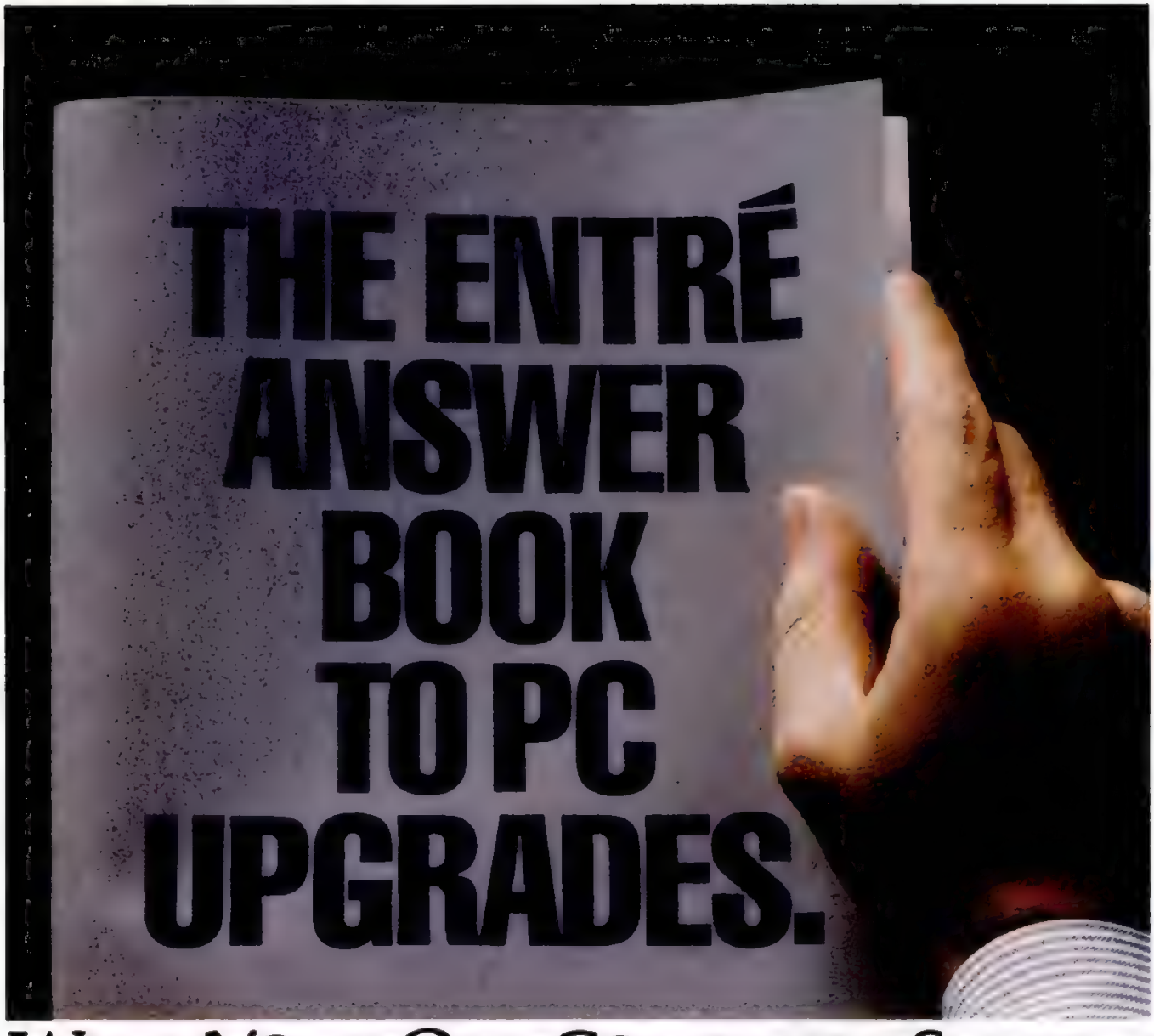
Although Arche Technologies is a new player in the computer field, its parent company, Pro-Kennex, is an established manufacturer of racquetball and tennis rackets. The $1,795 Arche Rival 286 is made in the United States and is built upon the same principle of quality that has given Pro-Kennex its competitive market edge. Arche Technologies is so confident of the Arche Rival 286's construction quality that it offers a 2-year warranty.

The first thing you notice when you look at the Arche Rival 286 system is its small footprint—6 inches high by 17 inches wide by 17¼ inches deep—and aesthetically pleasing design. Its solid construction and attention to detail—everything is nicely finished inside and out—inspire confidence.

SWITCHABLE SYSTEM The Arche Rival 286 is an 8/12-MHz switchable system. The turbo switch and the reset switch are conveniently located on the front panel of the system; however, the power switch is located in the customary place on the right side of the case. An indicator light lets you know when you're operating at the 12-MHz turbo speed.

But the most striking system component is the 14-inch amber monochrome monitor, which is manufactured by Arche Technologies. This flat-screen phosphor display has 1,000-line resolution in the center of the screen and 800-line resolution at the corners. It has the usual brightness and contrast controls on the left side of the monitor and has vertical and horizontal hold adjustments at the rear of the monitor.

The monochrome video adapter board that comes with the system doesn't have



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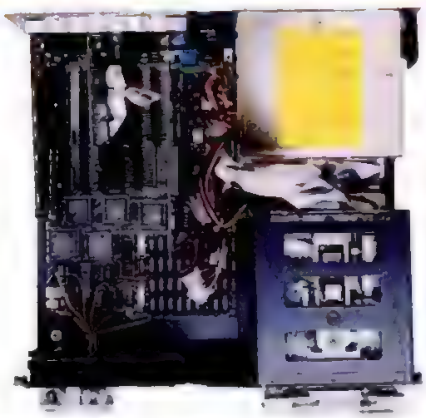
CIRCLE 173 ON READER SERVICE CARD

An Editor's Choice, the Arche Rival 286 is most admirable for its excellent 14-inch, flat-screen high-resolution amber monitor, which is standard in the $1,795 system. Hard disks are available, but you'd do best to add your own. The tested disk turned in a 70-millisecond access time.



graphics capabilities, so I replaced the original board with a Hercules graphics board. The display was even better yet; this monitor is a standout.

The system is designed around the Chips and Technologies' VLSI AT chip set. The unit I evaluated came with 1MB RAM on the motherboard, although 640K RAM is standard for the basic system. Four banks of 256K-bit 100-nanosecond parity-checked RAM chips are arranged in a standard configuration, running with one wait state. There is an open socket available for the Intel 80287 coprocessor chip.

The Arche Rival 286 has the usual eight expansion slots (two 8-bit and six 16-bit) and has three half-height drive bays. The clock/calendar uses a rechargeable 3/600K nickel cadmium battery from Varta. This battery will recharge itself from the power supply and should last 5 years or so; the 200-watt Senstron power supply has four device connectors. The system I evaluated came with a 1.2MB 5¼-inch Teac floppy disk drive, which is not spring-loaded, and a 20MB Seagate ST-225 hard disk. Although Seagate produces reliable hard disks, this one is slow—rated at 70 milliseconds. Since it will cost you an extra $400 over the base system price, I would recommend that you look elsewhere and get a better price—or a faster disk.

The basic $1,795 price includes DOS 3.3. The Award Software setup program, which is part of the Award BIOS, is encoded into 200-ns. EPROM chips and is accessible from the keyboard by pressing the Ctrl-Alt-Esc key combination.

The manual was away at the printer's at review time, so Arche sent me a typeset copy. The 54-page version I saw seems to be directed toward the novice: it's well written, contains lots of pictures and a good index, but has little in-depth technical information.

HOMEMADE Many components of the Arche Rival 286 are manufactured by Arche Technologies: the controller card can handle two floppy disk drives and two hard disk drives; the monochrome video adapter/printer card has a 9-pin TTL video port and a 25-pin parallel port; and the peripheral port card has another 25-pin parallel port and two serial ports.

The keyboard supplied with the system is Unitek's enhanced AT-style 101-key keyboard. It has a good, stiff, over-the-center feel though it can't really approximate the feel of an IBM keyboard.

The Arche Rival 286 is a consistently solid, although not spectacular, performer for its class. It sets itself apart with its aesthetic styling, quality construction, and a superior monitor. The only weak link in this otherwise solid system is the extremely slow (and optional) hard disk.

—Catherine D. Miller

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AboveBoard 2 ⌀k *(for MicroChannel)*	279.
8087 *(for IBM-PC & XT)*	114.
8087-2 *(for PS/2 Models 25 & 30)*	159.
80287 *(for AT & XT286)*	195.
80287-8 *(for 8 MHz 80286 machines)*	249.
80287-10 *(for PS/2 Models 50 & 60)*	319.
80387 *(for 16 MHz PS/2 Model 80)*	499.
80387-20 *(for 20 MHz PS/2 Model 80)*	749.
Kensington Microware ... 1 year	
Masterpiece	94.
Masterpiece Plus	109.
key tronic ... 3 years	
101 Keyboard *(enhanced layout)*	99.
Kraft ... 1 year	
Three-button Joystick	33.
KYE International ... 1 year	
Genius Mouse Model GM-6 Plus	59.
Microsoft ... lifetime	
SPECIFY BUS OR SERIAL VERSION	
Mouse with Paintbrush	109.
Mouse with Easy CAD	125.
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Migent ... 1 year	
Pocket Modem *(1200 baud, incl. software)*	119.
MSC Technologies ... lifetime	
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PC Mouse w/Autosketch	105.
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Multisync II *(800 x 560 max. resolution)*	call
NSI Logic ... 3 years	
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Orchid Technologies ... 2 years	
Tiny Turbo 286	289.
Designer VGA	349.
PC Cooling Systems ... 1 year	
REPLACEMENT POWER SUPPLIES	
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Turbo Cool 200 *(run 30° - 45° cooler)*	169.
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Practical Peripherals ... 5 years	
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1200 Baud Internal Modem *(w/ProComm)*	69.
1200 Baud External Modem	109.
2400 Baud Internal Modem	special
2400 Baud External Modem	special
Princeton Graphics ... 1 year	
MAX-12E *(amber monochrome monitor)*	139.
Ultrasync *(supports CGA, EGA, VGA)*	$549.
Quadram ... 2 years	
ProSync *(with mouse)*	259.
Microfazer II Print Buffer 64k	249.
Quad386XT	859.
Toshiba ... 1 year	
P321SL printer *(80 col., 216 cps, w/tractor)*	529.
P351SX printer *(136 column, 216 cps)*	999.
T1000 Laptop *(80C88, 6.4 lbs., 5 hr. battery)*	call
T1200 Laptop *(80C86, 10 MHz, 20 Meg)*	call
T3100/20 Laptop *(80286, 8 MHz, 20 Meg)*	call
T3200 Laptop *(80286, 12 MHz, 40 Meg)*	call
T5100 *(80386, 16 MHz, 40 Meg)*	call
768k Ram Card for T1000	299.
Video 7 ... 2 years	
VEGA Deluxe *(supports 640x480)*	209.
VEGA VGA *(supports full VGA specs)*	287.

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IOMEGA ... 1 year	
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Bernoulli II Dual 20 Meg External *(5¼")*	1679.
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Bernoulli Box 40 Meg	1679.
20 Meg cartridge *(8")*	82.
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PC2B Card *(bootable card)*	229.
PC4 Card *(for PS/2 Model 50/60/80)*	299.
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40 Meg External Tape Drive *(XT, AT or PS/2)*	479.
40 Meg External Tape Drive w/Power Supply *(XT, AT or PS/2)*	569.
Plus Development ... 1 year	
Hardcard 20 Meg *(49 ms)*	569.
Hardcard 40 Meg *(39 ms)*	725.
Seagate ... 1 year	
FREE PCTV® Hard Drive Installation Tape with the purchase of 20 Meg Seagate drive for the IBM PC (not for AT). Specify Beta or VHS.	
20 Meg Internal Hard Drive ST225 *(w/controller and cables, 65 ms)*	299.
30 Meg Internal Hard Drive ST238 *(w/controller and cables, 65 ms)*	329.
40 Meg Internal Hard Drive for AT *(40 ms)*	439.
40 Meg Internal Hard Drive for XT *(w/controller and cables, 40 ms)*	499.
TEAC ... 1 year	
PC, XT 360k Drive *(5¼" half-height)*	99.
720k Drive *(3½" half-height, specify XT or AT)*	99.
Toshiba ... 1 year	
AT 360k Drive *(5¼" half-height)*	99.

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Marlow, NH 03456
603/446-3383 **FAX** 603/446-7791

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Sony *(10 disks per box)*	12.
Maxell MD2-D *(10 disks per box)*	13.
Verbatim Datalife *(10 disks per box)*	13.
5¼" DS/High Density Disks for AT *(1.2 Meg)*	
Fuji MD2HD *(10 disks per box)*	22.
Sony *(10 disks per box)*	23.
Maxell MD2-DD *(10 disks per box)*	23.
Verbatim Datalife *(10 disks per box)*	22.
3½" DS/DD Diskettes *(720k)*	
Sony *(10 disks per box)*	18.
Fuji *(10 disks per box)*	19.
Maxell *(10 disks per box)*	20.
3½" DS/High-Density Diskettes *(1.44 Meg)*	
Fuji *(10 disks per box)*	55.
Maxell *(10 disks per box)*	59.

MISCELLANEOUS

CompuServe	
CompuServe Information Service	24.
Grolier's OnLine Encyclopedia	32.
Cables ... lifetime	
Smartmodem-to-AT cable *(9 feet)*	15.
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- Call 603/446-3383 for information.

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CORE INTERNATIONAL

Core ATomizer

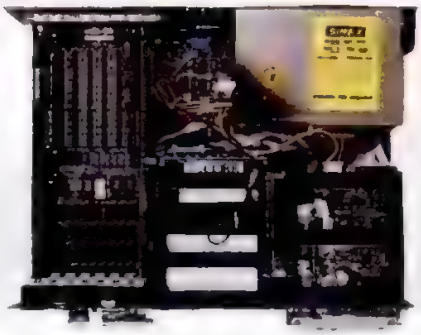
In the past few years we have seen AT compatibles marketed by companies that are well known for making other things like monitors, printers, and even cars. Now consider the long-awaited revision of the ATomizer, from Core International, a maker of high-performance hard disks.

Core has taken its advanced disk drive technology and fed it into an AT clone with positive results. At $1,350, the ATomizer comes with 512K RAM; a 1.2MB 5¼-inch floppy disk drive; one parallel and one serial port; a combination floppy/hard disk controller; an IBM Enhanced-style keyboard; and six 16-bit and two 8-bit expansion slots. There is room for two more exposed half-height storage devices and one full-height disk drive. The 21-inch system unit is extremely sturdy and somewhat bulky; you may want to try to put it under your desk.

The ATomizer operates at a switchable 6, 8, or 12 MHz and contains the Phoenix BIOS, Version 3.06. Memory on the motherboard can be expanded to 4MB using 1MB chips, and additional memory can be included on expansion boards up to the 16MB limit.

HIGH-CAPACITY HARD DISKS The Core HCR controller card is specially equipped to run high-capacity hard disks and contains circuitry that can support hard disks using a 1-to-1 interleave. The HCR controller also passes information to and from the disks much faster than a normal ESDI/506 controller (like the one in the IBM PC AT) would. In order to take full advantage of the HCR controller, you should use a high-capacity disk. Obviously, Core offers a number of different disk choices: some are aimed at those looking for a good buy, while others are geared toward those whose main concern is real

Core International's rugged ATomizer is a full-size 12-MHz AT compatible that, as you might expect, turned in the best hard disk performance times of the machines reviewed here. Inside, the standard AT-like eight-slot configuration is found.

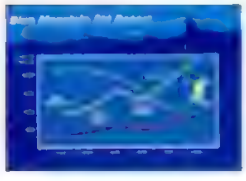


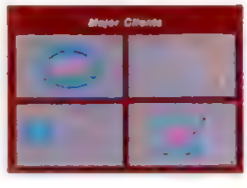
FACT FILE

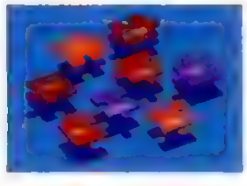
Core ATomizer
Core International
7171 N. Federal Hwy.
Boca Raton, FL 33487
(305) 997-6055
List Price: With 512K RAM, one 1.2MB 5¼-inch floppy disk drive, DOS 3.3 or Xenix, $1,350; 40MB hard disk, $876; monochrome monitor and card, $285; 14-inch EGA monitor and card, $600.
In Short: A reliable, fast, 12-MHz machine with powerful mass-storage capabilities from a company known for its big, fast hard disks. The system is sturdy, with plenty of room for one or more full-height disk drives. An ideal machine for applications that require high capacity and speed.

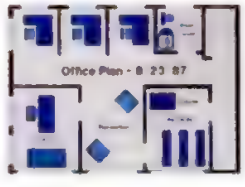
CIRCLE **681** ON READER SERVICE CARD

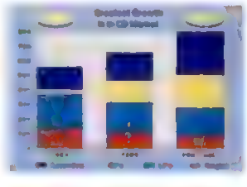
Of all the graphics you can create with Freelance Plus,

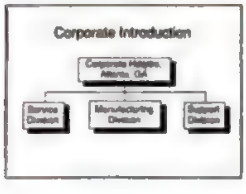


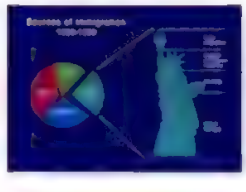


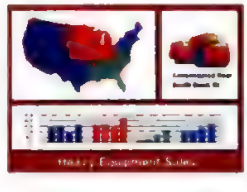


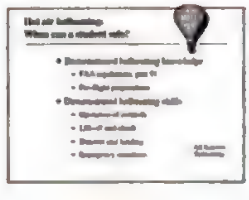


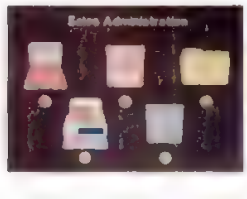


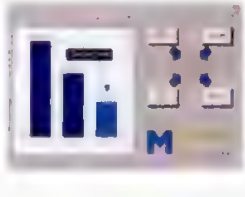


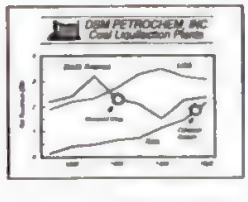


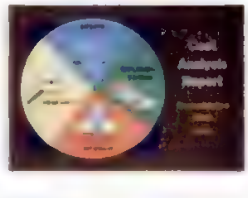


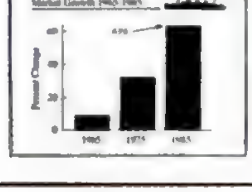


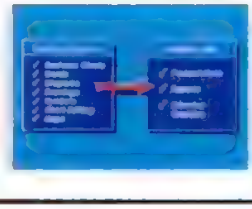












speed, the kind Core is famous for.

If you order an ATomizer equipped with a hard disk from Core, all you have to do is specify whether you'll be using DOS, OS/2, or Xenix. Core will low-level-format the hard disk and run setup by request. Core does not supply a copy of the operating system with each unit, but you can purchase one separately.

■ You pay a little more for the Core disk drives, but in return you get a machine that offers reliability, data security, and speed.

Our evaluation unit contained a Core Optima 40MB hard disk ($876) with DOS 3.21 installed. It also included a respectable Mitsubishi-made 14-inch EGA monitor and adapter card ($600), bringing the total cost of the evaluation unit to $2,826. The ATomizer performed the benchmark tests with no major problems and finished first in disk testing.

The keyboard shipped with the evaluation unit was an 84-key, AT-style keyboard that had a mushy feel to it, but a representative said that Core now ships only 101-key, Enhanced-style keyboards with the ATomizer. The new keyboard did not arrive in time for evaluation, but it can only be better than the other keyboard.

The documentation is basic enough to guide new users through installation and setup and advanced enough for more-experienced users. Bundled with each ATomizer is Core's own Corefast backup and file management utility, as well as a Core utilities disk.

Included with the ATomizer are several manuals that contain separate sections for installing and configuring the disk drives, getting started with the Corefast backup program, and even instructions on upgrading for Novell software when using a Core disk drive.

TECH SUPPORT If you encounter any problems when configuring the ATomizer, Core offers free technical support for the length of the warranty. The warranty for the ATomizer system unit is 1 year; for a Core disk drive, 3 years. Extended 2- or 3-year warranties for the ATomizer ($200 and $350) are available.

When the unit is returned for repairs, Core pays the shipping one way. Problems with the system unit are fixed by third-party maintenance technicians, but if the Core disk drive is the problem, Core will replace it (for free if the problem occurs within the 3-year warranty period).

Based on price and performance, the ATomizer is a good buy. Even when you add the price of a hard disk, monitor, and adapter card, the system is a reasonable $2,800 to $3,000. You pay a little more for the Core disk drives, but in return you get a machine that offers reliability, data security, and speed.—**Greg Alwang**

DATAWORLD

Dataworld Data 286

The Data 286 from Dataworld, the southern California–based mail-order firm, is a zero-wait-state, 12-MHz machine with 512K of 60-nanosecond RAM, and a 12-inch EGA monitor and card. The Data 286 costs $1,605 and comes in a full-size system box, 6½ by 19½ by 16½ inches (HWD), the advantage being the full complement of eight expansion slots: six 16-bit and two 8-bit. One of the 16-bit slots holds the hard/floppy disk controller.

The zero-wait-state memory setting is very fast, and Dataworld has chosen to ensure memory reliability with faster-than-normal RAM chips. While other vendors typically install 80-ns. chips for 12-MHz zero-wait-state machines, Dataworld uses more-expensive and faster 60-ns. chips. According to Dataworld, the 60-ns. chips have a better chance of working well under the high-heat situations that often occur in full-size boxes stuffed with expansion cards.

SWITCHING WAIT STATES If you want to switch between zero wait states and one, it's easily accomplished with a rear-mounted toggle switch. Other conveniences include front-panel buttons to switch between the 12-MHz turbo mode and the slower 8-MHz speed for products that don't work at higher speeds.

All of the internal components are either industry standards or acceptable substitutes. The finish work is of fine quality, and the box suitably rugged. The 200-watt power supply has four power lead device connectors and includes a switched outlet in which to plug a monitor power cord.

The Data 286 uses the ubiquitous Phoenix 80286 ROM BIOS, in this case Version 3.07/00. Phoenix setup software is also included, although the IBM Advanced Diagnostics setup program works as well.

The Data 286's keyboard is of the IBM Enhanced style and is manufactured by Focus Electronics. The keyboard is particularly good and a pleasure to work with. It has a reasonable amount of tactile feedback, good travel, and a reassuring click. It feels especially sturdy.

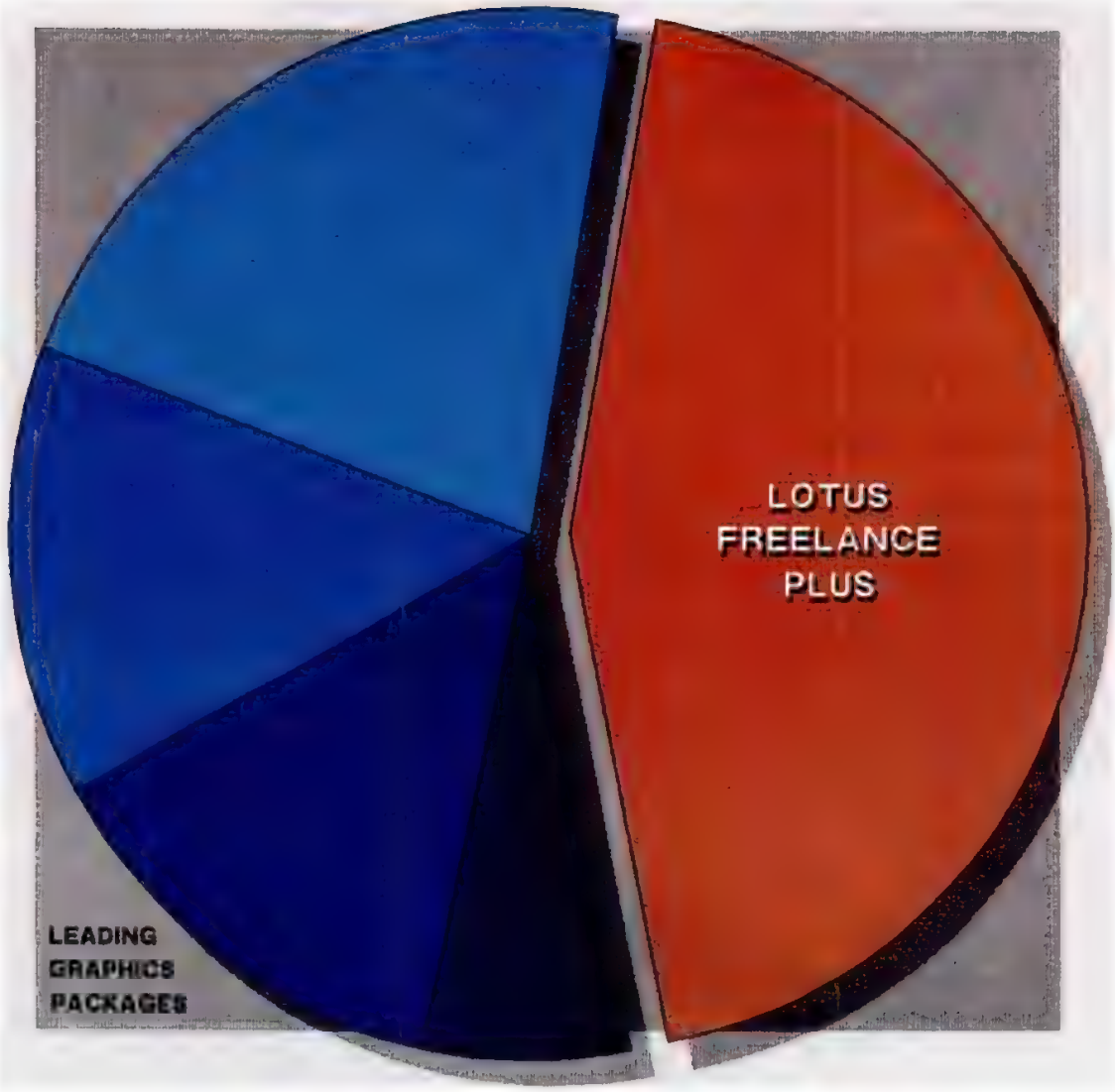
Neither DOS nor any version of BASIC comes standard with the Data 286, as it does with all the other machines reviewed here except for the Star Industries AT 286. The only software included is the setup program, so when you compare prices be sure to add $99 for DOS and BASIC. A helpful booklet has fairly clear descriptions of system switch and jumper settings. The booklet also has an accurate line drawing of the motherboard and electronic

PC MAGAZINE FACT FILE

Dataworld Data 286
Dataworld
3717 San Gabriel River Pkwy.
Pico Rivera, CA 90660
(800) 722-7702
(800) 722-7734 (in Calif.)
(213) 695-3777
List Price: With 512K RAM, one 1.2MB 5¼-inch floppy disk drive, 12-inch EGA monitor and card, $1,605; 40MB hard disk, $585; 512K memory upgrade, $150
In Short: A fairly standard AT compatible that runs at speeds of up to 12 MHz at zero wait states. Very-high-speed 60-nanosecond memory chips help ensure reliable performance. The price is right, but service is available only on the West Coast.

CIRCLE 680 ON READER SERVICE CARD

This is the one we're particularly proud of.



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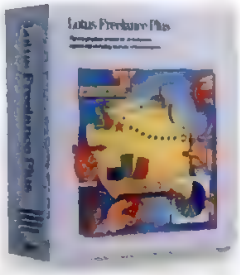
Freelance Plus lets you create everything from data-driven charts like bar charts, to graphics based on ideas like flowcharts. And Freelance Plus is the complete graphics solution, because you get all the tools you need for creating effective business graphics in a single package.

What's more, Freelance Plus is compatible with other Lotus software, like 1-2-3,® Symphony,® and Manuscript.® And it's incredibly easy to use.

Find out why Freelance Plus has the biggest slice of the pie. To order a $10 demo kit, call 1-800-345-1043 and ask for demo kit ADW-1658. Lotus Freelance Plus



*Based on national audits conducted by Audits & Surveys, Inc., May-December 1987.

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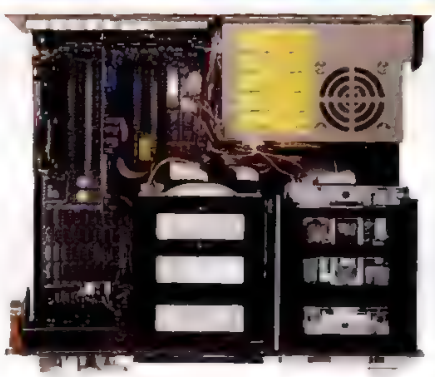


The Dataworld Data 286 offers 12-MHz speed and excellent compatibility in a full-size chassis that may be hundreds of dollars less expensive than other AT compatibles. A system with a 40MB hard disk and an EGA monitor can cost as little as $2,190.

components, a measure of detail other vendors sometimes omit. A 40-page user manual covers the system's installation and setup procedures.

Dataworld machines need to be shipped to the West Coast for service. The vendor pays for ground shipping one way, and its service department tries for a 3-day turnaround. If you call with a service problem and the technicians are able to determine the faulty component over the phone, they'll have you take the suspect piece out of your machine (if you feel capable) and ship it west, which costs less for both sides. The system comes with a 1-year warranty for parts and labor.

The bonus for accepting the potential service inconvenience is price. Our evaluation unit, complete with EGA card and monitor and the 40MB hard disk, was priced at $2,439. You get a high degree of AT compatibility, faster memory chips than from most vendors, and several convenient features in a full-size box for significantly less than you would pay for other, name-brand computers at local dealers.—**Bruce Brown**

EPSON AMERICA INC.

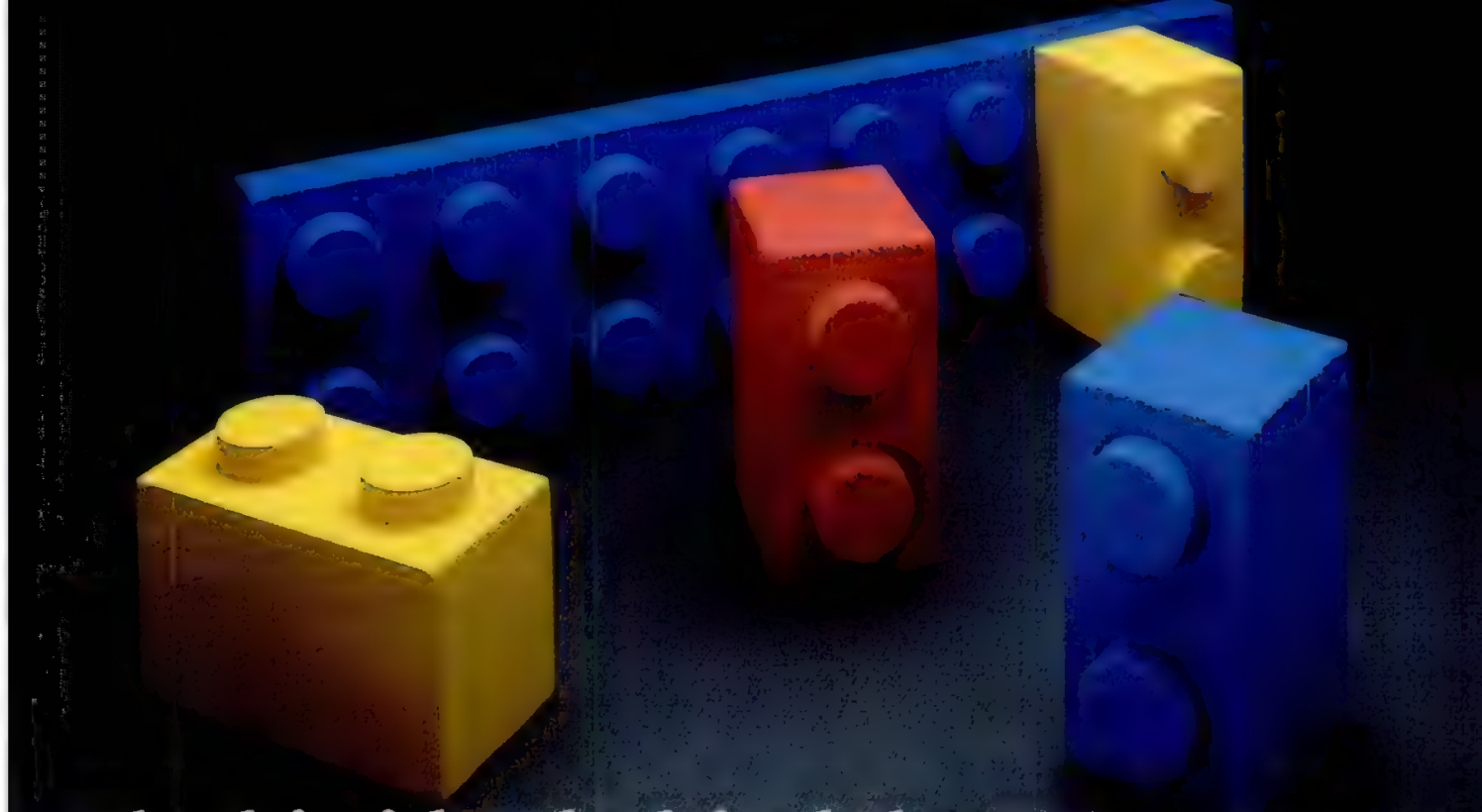
Epson Equity II Plus

Epson America keeps right on rolling with new products and product updates. The Epson Equity II Plus is the latest version of Epson's small-footprint, all-purpose 80286 computer. With a base price of $1,595, the 10-MHz Equity II Plus is $500 cheaper than Epson's top-of-the-line Equity III Plus, which gives you more expansion slots, faster operation, a bigger box, and a top operating speed of 12 MHz.

For your $1,595, Epson gives you a 640K, 8/10-MHz, one-wait-state AT compatible. Configured with a 40MB hard disk and an EGA monitor, the price of the system is $3,643. The Equity II Plus completed all of our benchmark tests handily and achieved the speed performance scores its clock and wait-state setting would suggest. There are no surprises here, which is good news in a developed product niche that should be predictable but often isn't.

The Equity II Plus's system box is a small unit, 6.1 by 15.7 by 16.3 inches (HWD), that weighs 19.8 pounds. It doesn't take up much room on your desk, but if you put the 7.7-inch-deep keyboard in front of the system unit, you'll need a minimum desk depth of 24 inches plus some room in back for cables.

The computer is good looking but doesn't call attention to itself with any particularly startling exterior features. Inside the box, however, the power switch mechanism looks pretty silly. There is a long metal arm that extends from the front-mounted power switch to the back of the



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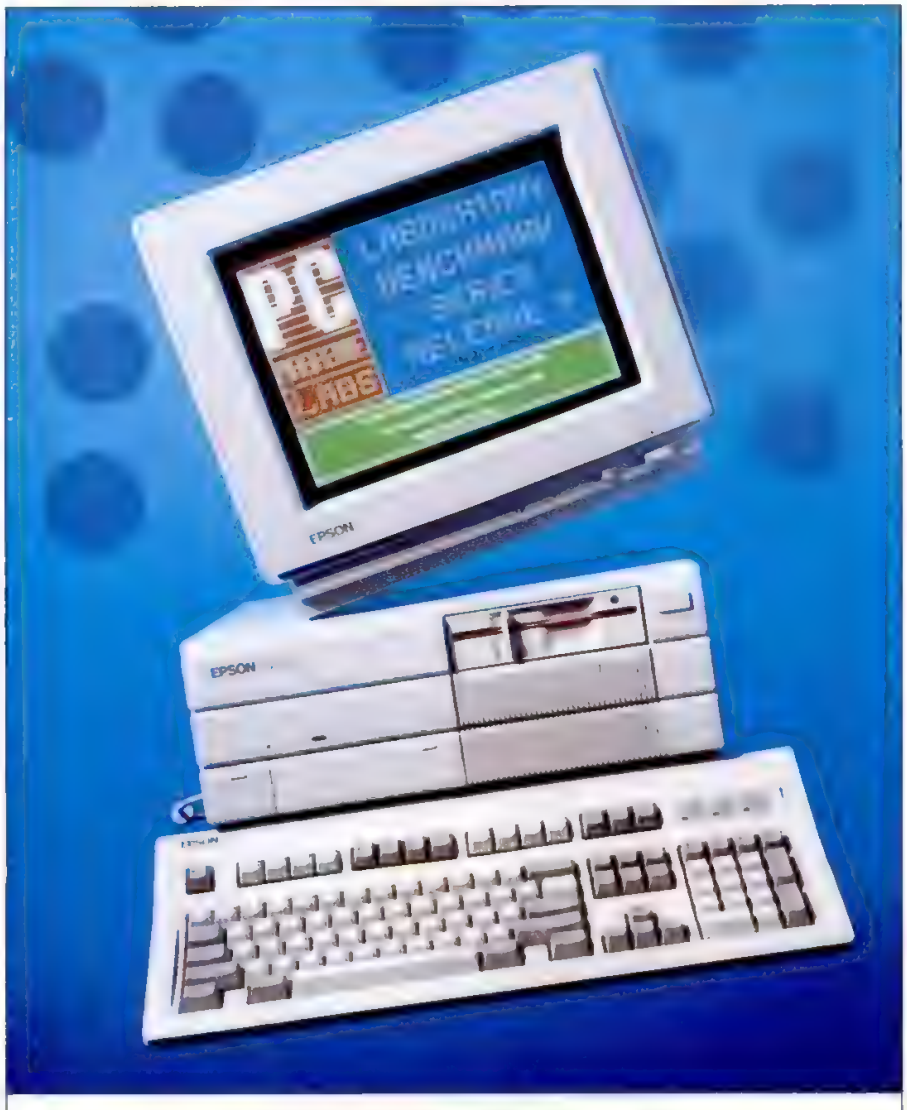

The Epson Equity II Plus is a small-footprint, 10-MHz AT compatible. Inside, note the separate controllers for the floppy disk drive and the hard disk, and the long arm that extends from the on/off switch in front of the machine to the power supply in the back.

PC MAGAZINE FACT FILE

Epson Equity II Plus
Epson America Inc.
2780 Lomita Blvd.
Torrance, CA 90505
(213) 539-9140
List Price: With 640K RAM, one 1.2MB 5¼-inch floppy disk drive, $1,595; with 40MB hard disk, $2,795; monochrome monitor and card, $248; RGB monitor and card, $568; EGA monitor and card, $848.
In Short: A small-footprint, 10-MHz system with quality components, most—including the BIOS—manufactured by Epson. The only markedly different components are separate floppy and hard disk controller cards that eat up an extra slot. Sold and serviced through dealers, so discounts can be found and service is close by.

CIRCLE 679 ON READER SERVICE CARD

machine and pushes a button on the 140-watt power supply. The mechanism seems out of place in an otherwise cleanly designed machine.

Configuring the Equity II Plus with the supplied Set-Up software is simple. It involves making selections from a single screen menu that lists options in pop-up windows. The Set-Up utility on IBM's AT Advanced Diagnostics disk also works.

The Equity II Plus is available with a variety of disk drive units. A 1.2MB 5¼-inch half-height floppy disk drive is standard with the system; a 360K 5¼-inch and a 720K 3½-inch floppy disk drive are optional. The only hard disk option is the 28-millisecond CDC 40MB hard disk that Epson also sells with the Equity III Plus. There is space in the system unit and power hookups for up to three half-height drive or tape devices.

INSIDE THE BOX You get just six expansion slots with this unit (three 16-bit and three 8-bit), though they are probably enough for most single users. The standard interface card includes the controller for the floppy disk drive and parallel and serial ports. It takes one of the 8-bit slots. If you add a hard disk to the Equity II Plus, you have to use a separate hard disk controller. The evaluation unit came with a Western Digital controller for the CDC hard disk.

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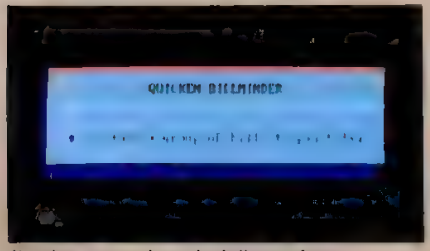

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merely all right, with reasonable response and feel. The keyboard isn't good enough to rave about, but it won't keep you from buying or using the machine, either. Like other Epson machines, the Equity II Plus has the keyboard plug on the left front side of the system unit, an improvement over the more common back-of-the-box location.

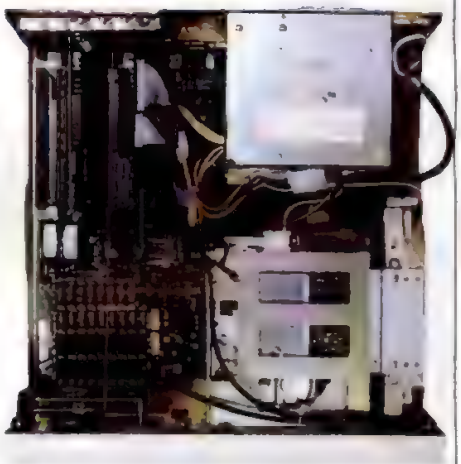
Epson usually supplies extensive documentation for its products, and the Equity II Plus is no exception. Three thick manuals cover the included MS-DOS 3.2, GW-BASIC, and a user guide and diagnostics. *SpeedStor* hard disk backup software also comes standard.

Epson produces its own BIOS, which passed all of our compatibility tests. The only feature on the whole machine that is different from the norm is the separate floppy and hard disk controller cards.

One of the best things about the Equity II Plus is its manufacturer. While many AT-class machines have to be shipped across the country for service or cared for by regional service centers, Epson is a standard brand name and its computers are generally sold through dealers who also supply support and service.

The Equity II Plus is neither the fastest nor the fanciest AT-class machine. Epson positions this unit as an all-purpose machine for end users who need middling 80286 power but don't want to give up a lot of desk space. If you need 12-MHz speed or nine slots, Epson is happy to sell you the Equity III Plus, but many users need look no further than the Equity II Plus.—**Bruce Brown**

The small footprint of the Hyundai Super-286C is achieved by slicing out two expansion slots and mounting the half-height hard disk vertically. The $1,499 machine comes standard with an EGA Wonder Card and one parallel and two serial ports.



HYUNDAI ELECTRONICS AMERICA

Hyundai Super-286C

Hyundai markets the Excel—its fast-selling import econocar—as the best possible combination of price and features. There are cheaper cars (if you want to call the Yugo a car), but Hyundai claims that you won't find a better deal when you consider all of the Excel's standard equipment.

The same philosophy seems to be behind Hyundai's economy computer, the Super-286C. With a base price of $1,499, it's several hundred dollars more expensive than the cheapest AT compatibles.

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	NOP	80386 Instruction Mix	Floating Point Calculation	Conventional Memory
ZEOS 386/16 Tower	2.1	3.6	13.6	0.5
ZEOS 386/20 Tower	1.7	3.0	10.8	0.4
IBM PS/2 Model 80-071	2.1	4.4	15.6	0.6
Compaq Deskpro 386/16	2.1	4.0	15.5	0.8

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PC MAGAZINE FACT FILE

Hyundai Super-286C
Hyundai Electronics America
4401 Great America Pkwy
Santa Clara, CA 95054
(408) 980-7561
List Price: With 640K RAM, one 1.2MB 5¼-inch floppy disk drive, DOS 3.2, EGA Wonder Card, $1,499; with second floppy disk drive, $1,599; with 30MB hard disk, $1,999; with two floppies and hard disk, $2,099; 14-inch monochrome monitor, $250, EGA monitor, $308.
In Short: A small-footprint, 10-MHz AT compatible that offers good quality for a good price. Standard EGA Wonder card is an advantage, as are motherboard-mounted ports.
CIRCLE 678 ON READER SERVICE CARD

But the system comes in a nearly complete configuration, unlike other clones whose base prices don't include such "luxuries" as ports and a video card.

LOADED MOTHERBOARD The Super-286C's motherboard has two serial ports, a parallel port, and a floppy disk drive controller built in. That should take care of I/O needs for most users, and it frees the expansion slots that would normally be devoted to I/O and the floppy disk controller.

A clock/calendar is also standard equipment, and the Super-286C comes with ATI's EGA Wonder monitor card. EGA support is an unusual feature to find as standard equipment, and it's even more surprising to find a name-brand component sitting in the slot. The EGA Wonder is one of the most widely sold EGA cards, and it offers auto-switching to accommodate different monitors and software.

To complete your Super-286C system, you need only add a monitor and a hard disk to go with the standard 1.2MB 5¼-inch floppy disk drive. A 14-inch monochrome monitor adds $250 to the price, while an EGA display will set you back $308 over the base configuration price. A 30MB hard disk brings the system price (less monitor) to $1,999.

Our tested configuration, with an amber monochrome monitor and a 30MB RLL Seagate hard disk, had a total price of $2,249.

The Super-286C is a small-footprint system, measuring 6 by 15⅞ by 16¼ inches (HWD). The Hyundai's smaller width accommodates a total of six expansion slots (four 16-bit, two 8-bit)—two fewer than the IBM PC AT. That's a consideration, but the motherboard-based ports and floppy disk controller lessen the need for additional slots.

The system's hard disk is mounted on its side, next to the cage that encloses the floppy disk drive bays. This somewhat unusual arrangement allows for installation of a second half-height floppy disk drive under the standard floppy, if desired.

Hyundai supplies the Super-286C with a relatively puny 135-watt power supply. That should be big enough to handle most peripherals, but a fully loaded bus might make the power supply wheeze a bit. Several other machines in this price class offer power supplies in the 190- to 200-watt range.

The Super-286C runs at keyboard-selectable clock speeds of 8 or 10 MHz. The usual Ctrl-Alt-Plus or -Minus key sequence changes speeds. The ROM BIOS is by Award Software, a name seen more and more often on clone motherboards.

BENCHMARK RESULTS In processor benchmark testing, the system performed in the normal range for a 10-MHz machine, 1.2 to 1.3 times faster than a standard IBM PC AT. I encountered some fairly strange results, however, in running our hard disk BIOS Seek test. The drive generated too many errors for the results to be useful. On an alternate test, which uses DOS calls instead of BIOS calls, the drive clocked in at an access time of 69.79 milliseconds, which is serviceable if not speedy. The problem with the BIOS speed test may have been related to the drive's use of RLL technology. In any event, in actual practice the drive performed without incident.

A few other minor annoyances marred my impression of this basically sound machine. The power switch is rear mounted, which prevents accidental shut-down but makes for blind groping when a cold boot is in order. The supplied keyboard, which mimics the IBM Enhanced layout, has a mushy, imprecise feel. Typing on it was tolerable but hardly a pleasure.

The overall construction quality of the Super-286C seems quite high. Add-in cards fit snugly into the expansion slots, and the machine has an overall air of solidity that's missing from many compatibles.

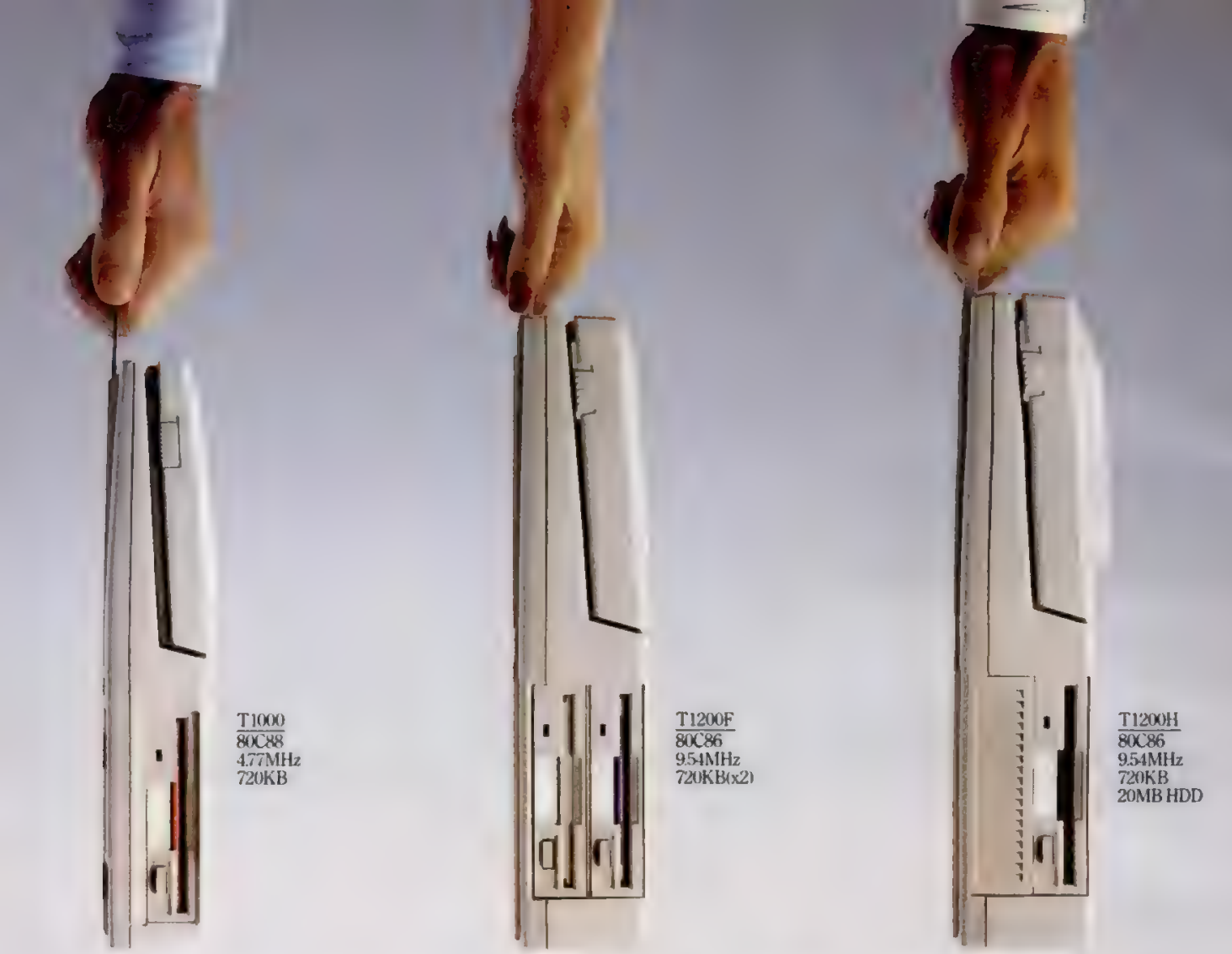
Hyundai is one of the giants that are making Korea's presence felt worldwide. The size and reputation of the company are reassuring when you are plunking down over $2,000 for a computer. Beyond that, the Super-286C has much to recommend it on its own merits. It's a very good system for the money.—**Jonathan Matzkin**

KAYPRO CORP.
Kaypro 286

Kaypro Corp. has made a point of not following in the paths of others. Its latest AT compatible may not be made with exactly the same recipe as most 286 machines, but it is certainly capable of grabbing a chunk of the pie. The Kaypro 286 is a 12-MHz machine that has a lot to offer, even though, like the Amdek System 286A, it strays from the norm. It's marked by a pretty hefty price tag, but it also offers a convenient upgrade path.

For $2,995, the Kaypro 286 comes with 1MB RAM; one 1.2MB 5¼-inch floppy disk drive; a 40MB hard disk (Fujitsu, Miniscribe, or NEC); one parallel and one serial port; a combination floppy/hard disk controller; an IBM Enhanced-style Maxi-Switch keyboard; and an adequate 12-inch Samsung monochrome monitor and card. At first glance, the Kaypro 286 looks like an IBM PC-XT, but after closer inspection it's easy to see that looks aren't everything. The dimensions are the same, and four half-height drive bays are accessible from the front of the unit, but that's where the comparison ends.

INSIDE STORY To pop the hood off the system unit, you have to remove 11 screws. After looking at the inside of the 286, you can see that Kaypro has taken a somewhat different approach in organizing the internals of the machine. Most noticeable is the missing motherboard. Like the Amdek System 286A, the Kaypro 286 takes advantage of slot technology and places all the motherboard components on a full-length microprocessor board. This



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Benchmark Tests: Low-Cost ATs

There were few surprises in the processor benchmark-test results. All three 10-MHz machines performed similarly, as did five of the six 12-MHz machines. The Amdek System 286A, with its 12.5-MHz clock speed, was a step ahead of the pack.

The Star Industries AT 286, the Arche Rival 286, and the Hyundai Super-286C were equipped with hard disks that didn't perform nearly as well as the others did but helped to keep the price of their systems' tested configurations down. In the case of the Star Industries machine, hard disk performance was compromised by an 8-bit hard disk controller. Conversely, the Core ATomizer sported an excellent 40MB drive that outperformed all the competition. Anything less from a company that is primarily a manufacturer of mass storage devices would have been a disappointment.

Performance Times

(Times given in seconds except where noted)

	NOP	80286 Instruction Mix	Floating-Point Calculation	Conventional Memory	File Access	DOS Disk Access (milliseconds)	BIOS Disk Seek (milliseconds)
8-MHz IBM PC AT	4.17	8.96	35.60	1.32	15.06	42.54	37.20
Epson Equity II Plus	3.35	7.08	27.95	1.02	11.16	29.99	27.61
Hyundai Super-286C	3.35	7.08	28.01	0.99	14.24	69.79	N/A
Star Industries AT 286	3.35	7.14	28.01	1.04	51.47	71.93	68.09
Arche Rival 286	2.80	5.89	23.40	0.88	14.75	81.22	69.23
Core ATomizer	2.80	5.82	23.12	0.85	11.09	29.73	18.95
Dataworld Data 286	2.80	5.82	23.18	0.84	11.44	33.02	30.35
Kaypro 286	2.75	5.83	23.12	0.85	11.21	35.54	33.70
Mitac Paragon 286F	2.75	5.82	23.17	0.82	13.13	35.01	32.26
Amdek System 286A	2.69	5.77	22.52	0.82	10.87	41.25	27.50

N/A—Not applicable: test could not be completed without errors.

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The **80286 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80286 instruction code. These instructions are a subset of the total processor instruction set.

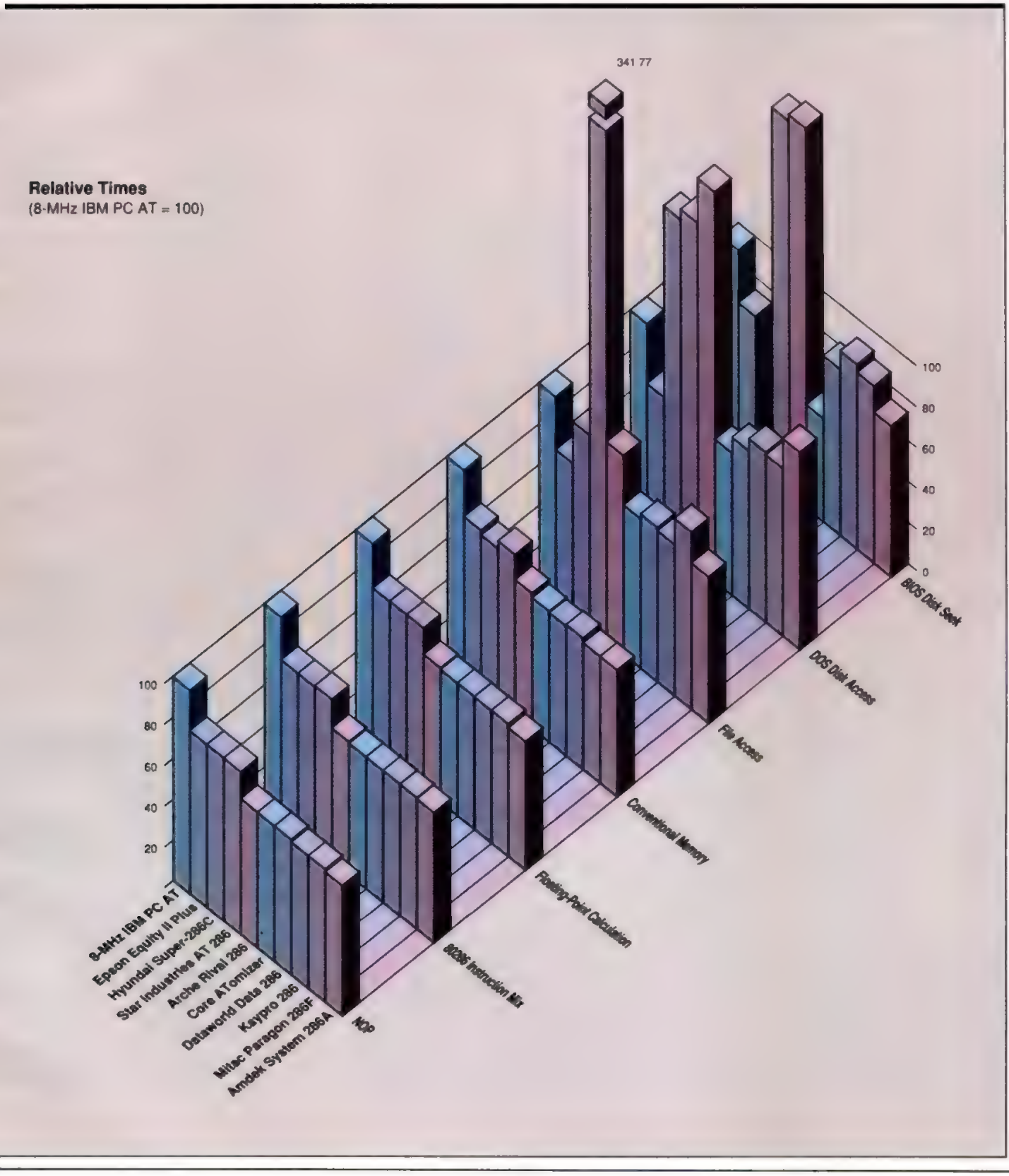
The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **File Access** benchmark test measures the time it takes to sequentially create and write a 256K data file using record lengths of 512 bytes and 4K. The test program then performs a series of operations: a sequential read of the same file, a random write, and a random read.

The **DOS Disk Access** benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3 and the interleave factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.


Relative Times
(8-MHz IBM PC AT = 100)
341 77
100
80
60
40
20
0
BIOS Disk Seek
DOS Disk Access
File Access
Conventional Memory
Floating-Point Calculation
8086 Instruction Mix
NOp
8-MHz IBM PC AT
Epson Equity II Plus
Hyundai Super-286C
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Core ATomizer
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Kaypro 286
Mitac Paragon 286F
Amdek System 286A

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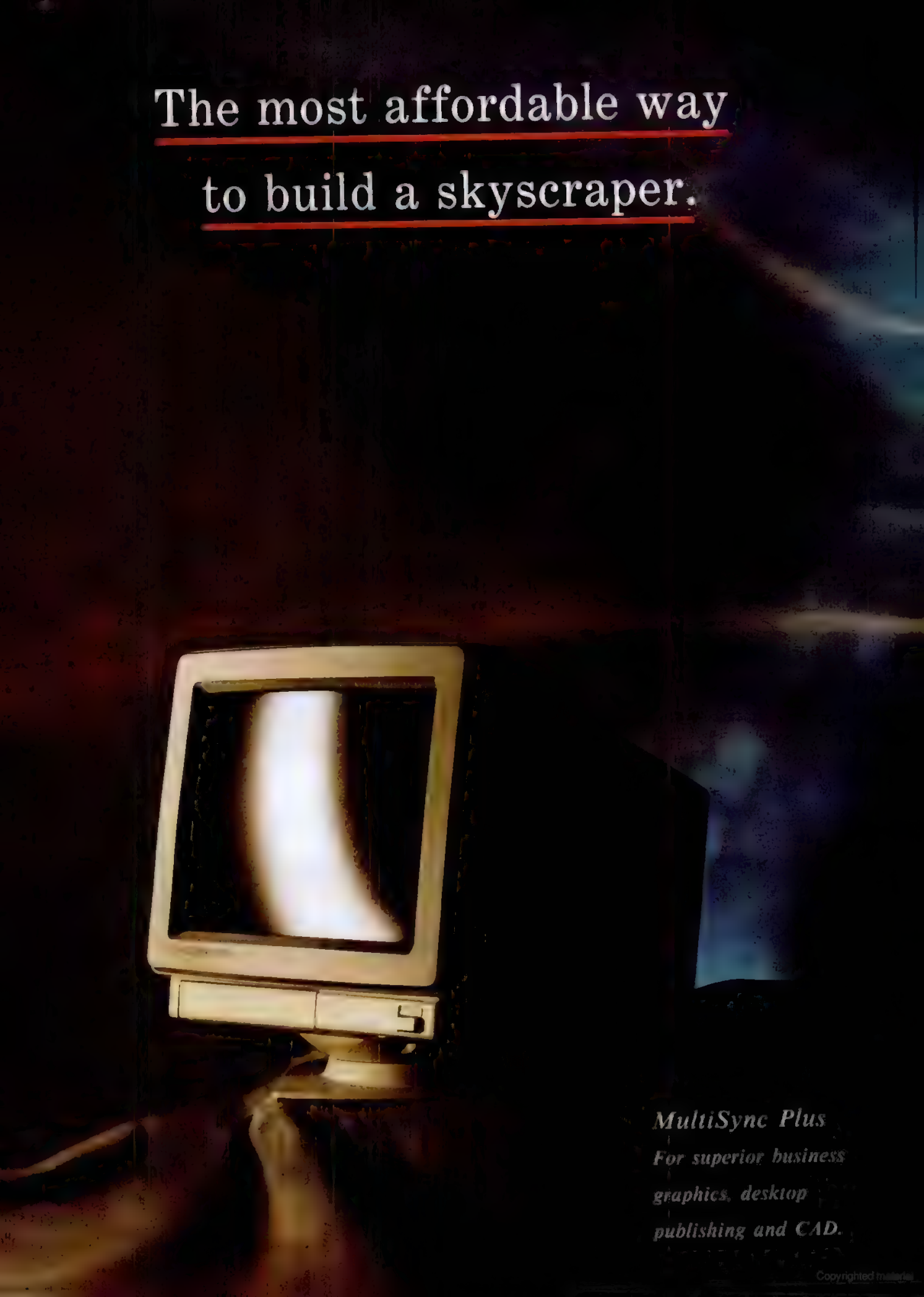

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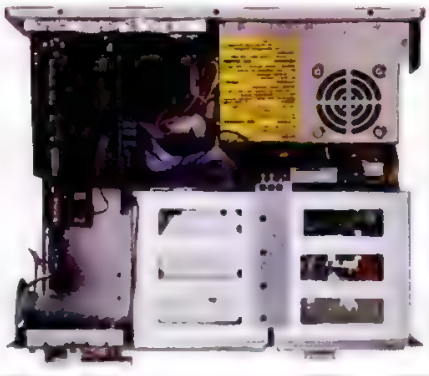
CIRCLE 115 ON READER SERVICE CARD

Like the Amdek System 286A, the Kaypro 286 features a backplane design, putting the 80286 processor on an expansion card and allowing for future upgrades. The $2,995 machine includes a monochrome monitor and a 40MB hard disk.



PC MAGAZINE FACT FILE

Kaypro 286
Kaypro Corp.
533 Stevens Ave.
Solana Beach, CA 92075
(800) 4-KAYPRO
List Price: With 1MB RAM, one 1.2MB 5¼-inch floppy disk drive, 40MB hard disk, 12-inch monochrome monitor and card, DOS 3.21, $2,995. EGA monitor and card, $575.
In Short: A 12-MHz machine with its motherboard components located on a full-length expansion card that leaves the possibility of an easy 386 upgrade wide open. The $2,995 price tag seems high, but the system is complete and includes quite a pile of software.

CIRCLE 677 ON READER SERVICE CARD

approach may seem a little strange at first, but it makes upgrading your microprocessor a breeze.

There are nine expansion slots available: five 8-bit and four 16-bit. Three 8-bit and two 16-bit slots are left after the system board, video card, I/O card, and controller are installed. The controller is a National Computer Ltd. combination controller and the BIOS is Phoenix, Version 3.07. A toggle switch and reset button are located on the back of the machine to either switch between 6 and 12 MHz or reset the computer.

The most unusual (and the most likable) feature of the Kaypro 286 is its separate microprocessor board. You have to like this feature after you discover how easy it is to upgrade your machine. Imagine just plugging a 386 microprocessor board into your 286 machine and instantly having 386 speed. With the Kaypro 286 it's possible and just over the horizon. As of this writing, Kaypro is in the process of developing a 386 upgrade board specifically for the 286 model. The upgrade board is expected sometime in the second quarter.

The Kaypro 286 performed all the benchmark tests with no problems and finished right up with the other 12-MHz machines tested. The 40MB hard disk had an average access time of 31 milliseconds. The only problem we had was getting the keyboard to work, but after switching to another Enhanced-style keyboard, we were up and running.

Bundled with the Kaypro 286 is a pile of software as tall as the computer. Besides MS-DOS 3.21, you also get *WordStar Professional*, Release 4.0; *WordFinder; SpeedStor;* and GW-BASIC. You'll also find several Kaypro utility programs that include a menu program that allows new users to set up menu choices for performing various DOS housekeeping tasks. Kaypro adds a nice touch by including two blank high-density floppy disks along with the many software programs.

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For more information about IZE, please contact your software dealer, phone us at 1-608-273-6000 or write Persoft, Inc., 465 Science Drive, Madison, Wisconsin 53711 U.S.A.

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Aside from software, there is also plenty of documentation to guide you through assembling, using, and ugrading your Kaypro 286. The user guide contains a useful tutorial to familiarize new users with the different aspects of the computer.

DEALER NETWORK Unlike many other compatibles, Kaypro machines are not available through distributors. Kaypro uses independent dealers to sell its systems. So, if you need to have your Kaypro 286 serviced, call your dealer. The warranty period for the 286 is 1 year, and Kaypro will pay for the shipping one way. Kaypro also provides a toll-free tech support line.

The Kaypro 286 is built with the future in mind. Kaypro tries hard to please and does a good job. Today the Kaypro 286 gives other 286 machines in its class a run for their money. Its big advantage is that tomorrow it may be running in the 386 pack.—**Greg Alwang**

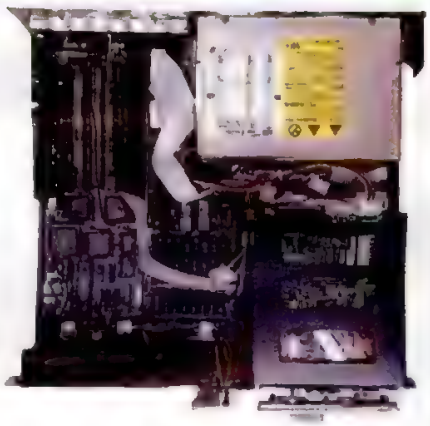
STAR INDUSTRIES

Star Industries AT 286

If you want quality, you're going to have to pay for it, right? Well, not always. Take the Star Industries AT 286. Here's a 10-MHz AT compatible with a lot of power and flexibility. Unlike some other compatibles, this one offers you the best of both worlds: quality at a very affordable $895 base price.

Unlike some other inexpensive compatibles, the Star AT 286 has a solid chassis with well-integrated components, all in a small-footprint box. The interior of the system unit looks like a scaled-down version of the IBM PC AT and holds no real surprises. The AT 286 comes equipped with 512K RAM on the motherboard, one 1.2MB 5¼-inch floppy disk drive, one parallel port, a monochrome video adapter, a built-in clock/calendar, a Western

With a base price of $895, the Star Industries AT 286 is one of the least expensive AT compatibles we've seen. The 10-MHz system tested by PC Labs included a monochrome monitor and a 30MB hard disk for a total price of $1,273. Hard disk performance was slowed by an 8-bit controller.



FACT FILE

Star Industries AT 286
Star Industries
7655 E. Redfield Rd., #8
Scottsdale, AZ 85260
(800) STAR-286
(602) 483-2854
List Price: With 512K RAM, one 1.2MB 5¼-inch floppy disk drive, $895; 30MB hard disk, $299; monochrome monitor and card, $79; EGA monitor and card, $508.
In Short: An inexpensive, small-footprint, 10-MHz machine that features standard components and a good keyboard. The 8-bit hard disk controller hurts hard disk performance.

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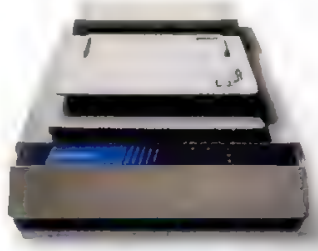

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CIRCLE 247 ON READER SERVICE CARD

EDITOR'S CHOICE

- **Amdek System 286A**
- **Arche Rival 286**

There were no real disappointments in this group of nine AT compatibles; in fact, all are acceptable choices. Two machines stand out in the crowd. The Amdek System 286A is a system of superior quality with an obsolescence-proof processor-on-a-card design. You'll pay handsomely for this machine—$3,595 for 1MB RAM, a 40MB hard disk, and no monitor—but you won't be disappointed.

Those with smaller budgets should investigate the Arche Rival 286. This machine came out of nowhere but will make a name for itself with its $2,195 price tag and outstanding flat-screen monochrome monitor. The hard disk that Arche offers isn't good enough for the rest of the system, so order the base system, install your own favorite hard disk, and you'll have an AT compatible to brag about.

As you shop for your AT compatible, keep in mind some of our other recent Editor's Choices. The CompuAdd Standard 286/10 was the best of the 21 inexpensive 286 machines that we evaluated in February (see "The Cheapest ATs Ever," PC Magazine, February 16, 1988). At $1,529 including monochrome monitor and 20MB hard disk, it's a high-quality bargain. A 12-MHz model is also available. Looking back a little further, the AST Premium/286 has proven to be one of the most popular AT compatibles of all since it first came on the scene over a year ago. Many dealers offer deep discounts on the Premium/286. If you can find a good deal, give it strong consideration.

For PS/2 fans wondering how the IBM PS/2 Model 50 stacks up against all this competition: $3,595 buys you a 10-MHz 80286-based machine with 1MB RAM, one 1.44MB 3½-inch disk drive, an agonizingly slow 20MB hard disk, and no monitor.

Digital hard disk controller, a separate floppy disk controller, and a Key Tronic Enhanced-style keyboard. There are eight expansion slots available—two 8-bit and six 16-bit—and five half-height drive bays. The power supply is a 200-watt Astec with five device connectors.

A convenient turbo switch on the front of the unit is used to toggle the AT 286 between 8 and 10 MHz (with one wait state), and a reset switch performs a cold boot. The Star comes with the Award 286 Modular BIOS, Version 3.01, but you can specify a Phoenix BIOS if you want one. The Key Tronic keyboard has a snappy feel to it, very much like the IBM Enhanced-style keyboards.

The configuration tested had a monochrome monitor and a 30MB Seagate ST-238 hard disk with DOS 3.21 installed. The total price was $1,273. It performed the processor benchmark tests flawlessly.

In hard disk testing, the AT 286 turned in extremely disappointing results. The disk's 68-millisecond access time was unfathomably slow until the problem was spotted. The Everex hard disk controller in the system (the floppy disk controller is separate) had an 8-bit rather than a 16-bit interface, resulting in a tremendous data traffic jam that slowed the disk to a crawl.

EASY TO RUN The AT 286 is easy to set up and use and can be run right out of the box. If you change the configuration and have to run setup, you'll have no problem because the setup is built into the ROM BIOS (this feature is available only with Award BIOS, Version 3.01).

The documentation consists of one 60-page manual that covers assembly of the AT 286, the basic DOS commands, the different hardware components of the system, and problem troubleshooting. Overall, the manual is quite informative and provides a very thorough overview of the system in understandable layman's terms. New users will probably want to keep this manual around as a handy quick reference. DOS doesn't come with the AT 286, but you can order it separately for $79. Star does include the popular shareware word processing program, *PC Write*, with each AT 286 unit.

■ Star Industries packs many quality components into the AT 286 for an uncommonly low price.

Surprisingly, Star Industries packs many quality components into the AT 286 system for an uncommonly low price. The use of name-brand components like Western Digital, Astec, Key Tronic, and Intel (DRAM) probably accounts for the fact that the AT 286 has an extremely low failure rate. If you do need customer support for the Star AT 286, it's free. The warranty for the AT 286 lasts 1 year, and any faulty parts are replaced free of charge for the first 30 days. And if a Star AT 286 has to be returned, Star Industries pays for the shipping.

BANG FOR THE BUCK The Star Industries AT 286 is a quality machine with lots of bang for the buck. Although it isn't the fastest 10-MHz machine available, it's certainly one of the least expensive. But if Star Industries sacrifices performance to keep the price down, as seems to be the case with the 8-bit hard disk controller, it should change its strategy. The quality of the Star Industries AT 286 and its compatibility make it a very attractive choice for cost-conscious buyers, but in today's marketplace no one wants to (and no one needs to) settle for less-than-optimal performance.—**Greg Alwang**

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We could go on about the many features of Symphony 2.0—how its macros let you automate complex or repetitive tasks and create customized applications. How the word processor now has a spelling checker and text outliner. And how database and communications have been improved.

The bottom line is that Symphony is one high performance package that's made to be opened up.

Lotus Symphony 2.0

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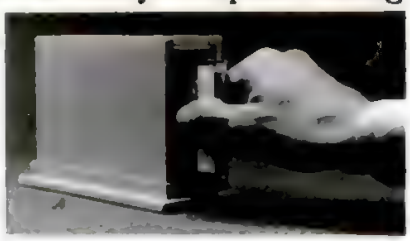

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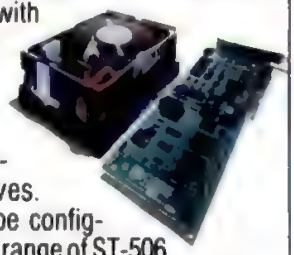

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Network File Servers. Novell Inc. has certified CORE's HC Series drives and controllers for use with NetWare version 2.1. Up to 3 gigabytes of storage may be configured. ATomizer 286 and 386 PCs also support other major LANs, including IBM Token Ring, 3Com and PC Net.

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CIRCLE 225 ON READER SERVICE CARD

SCIENTIFIC WORD PROCESSORS: FORMULAS FOR SUCCESS

No longer needlessly complicated and cumbersome, today's scientific word processors simplify the task of integrating text and technical character sets.

Those who use scientific and technical word-processors are, to echo the old saw about the rich, just like you and me—except they ask a lot more of their WP programs.

The scientific-technical WP arena is, in a very real sense, just an extension of standard, full-featured word processing requirements. However, it's important to remember that there's sci-tech, and then there's *sci-tech*.

Many of the requirements of those who prepare less-technical scientific papers and manuscripts can be met very well by one of the powerful word-processing packages we looked at in our roundup of word processors in the February 29, 1988, issue.

Microsoft Word and *Nota Bene*, particularly, have become popular with academics—and not only those in the humanities and soft sciences. Both programs manage footnotes superbly, a hallmark of technical typescript. Both have nifty internal boilerplate features, so that if you tire of typing a long, complex, or simply uncommon word or term used frequently in the paper—say, *riboflavin, hymenopterous*, or *acetylsalicylic acid*—you can use a keyboard-macro shortcut to insert that word or phrase.

Both programs (and others reviewed in that issue) also handle long manuscripts very well—a relatively recent development in PC-based word processors.

Old hands at PCs—who've lost a chapter or two in their time to the vagaries of power failures, hard disk crashes, and those mysterious gremlins who creep into our offices at night to perform unspeakable and untraceable acts on our computers—may still prefer to

save longer works in single-chapter files. But the convenience of managing a several-hundred-word manuscript in one large file is undeniable—and, now, maybe even sensible.

BEYOND WORDS For many scientists, engineers, and others whose words pass through a PC en route to publication, complex equations are at the heart of their work. And getting those equations onto the screen, onto the disk, and eventually onto paper is a major stumbling block with most PC word-processing software.

With many programs you enter the IBM extended character set symbols by holding down the Alt key while typing the character's three-digit ASCII code on the PC's numeric keypad. But it's not just getting those delta and pi symbols into the work one by one that counts. It's combining them in multiline mathematical expressions, or as elements of chemical formulas, that's the trick. And this brings most PC word processors—and those who use them—to their knees.

The problem of getting complex numerical expressions into the computer, then getting something approaching typeset results out the other end of the system, was addressed in the 1970s by Professor Donald Knuth at Stanford University.

Knuth developed *TEX*—pronounced "tech" by knowledgeable users, "tecchhhh" (as in "blecchhhh") by the true cognoscenti—not as a sneer but to match the correct pronunciation of the Greek characters from which its name is drawn. *TEX* is essentially a formatter that accepts what look like ordinary (if confusing) ASCII files and drives output devices to produce good-looking and intelligible results on paper.

TEX has a set of keyboard entry conventions that at first seem merely illogical but soon become really infuriating; however, they can eventually be memorized and used to represent the ups and downs of superscripts, subscripts, functions, and so on—all to produce those complex mathematical expressions on paper.

DIFFICULTY IS PRESERVED To say that *TEX* takes a little effort to learn is like saying that with a little effort you could build your own full-scale, working Challenger spacecraft and run your own space shuttle program.

Over the past 10 years—during which Knuth's system was widely adopted in universities and research institutions—*TEX* has become, in effect, the Departmental Secretaries' Full-Employment Act. Thousands of secretaries and typists in physics, chemistry, engineering, and other technical departments across the world owe *TEX* thanks: their employers cannot let them go, cutbacks or not, because no one else in the department understands *TEX* well enough to get their papers out if their secretaries were to leave.

MicroTEX, developed by David Fuchs and published in 1985 by Addison-Wesley, brings the glory of *TEX* to the PC. A full implementation of the Knuth standard, *MicroTEX* lets users who know *TEX* make a rapid transition to a much less expensive, much more appropriately scaled computer and laser printer combination than that provided by the departmental minis and institution-wide mainframes often used for scientific or technical word processing. It also offers a rich set of challenges (chuckle) to the newcomer.

AUTHORS AND WPs The complexities of *TEX*, and the cult of those who have learned if not quite mastered it, illustrates one of the problems fundamental to most scientific and technical word-processing tools until very recently: they were often too complicated for the authors themselves to use.

It's not that a Ph.D. in astrophysics *couldn't* learn them so much as that he shouldn't *have to*. Mastering a word processing program is a reasonable and necessary qualification for writing in the scientific and technical domains today. But mastering a needlessly complicated program just to get words and figures down on paper is poor use of a technical person's time.

From running labs to teaching to speaking at colloquiums to writing grant proposals to selling research programs to administrating or managing to maybe even finding a few minutes to *think* about what he is trying to do . . . well, the life of a respected technical professional has few spare moments.

This means, too often, relying on others to get fragments of papers and other sci-tech documents into the computer, then tidying them up. Which makes for bad papers and worse science. Which has led to the appearance of good alternatives.

THE LOTUS PRESCRIPTION *Lotus Manuscript*, for example, though in fact a good choice for many kinds of large, structured manuscripts, had been unabashedly positioned by Lotus as a sci-tech word processor suitable for an author's own use. Now Lotus will be marketing Version 2.0 of *Manuscript*, which we looked at in its beta release, as a general-purpose word processor.

Manuscript is a smart, capable, and civilized system, perfectly usable by the authors of sci-tech papers themselves (and not only by those who once "typed" their work) for text entry. It uses a set of equation-entry conventions similar to but more logical and easier to learn than those of *TEX*.

Better, it lets you start with a simple outline, expand that outline into a detailed, highly structured schema, and then gradually expand sections of that outline into a full-fledged manuscript. Because sections can be selectively collapsed to their headlines, you can keep "open" only the portion you are writing at the moment, while still seeing how that portion fits into the overall outline.

Manuscript also allows easy entry of tabular material and lets you draw rules, or lines, around and through those tables for more-attractive, more-readable results. And *Manuscript* can enfold graphs and charts from Lotus's own *1-2-3*, *Freelance Plus*, and *Graphwriter II* programs into its text, as well as compatible graphics files from other vendors' programs.

Manuscript is a good example of how much more PC-like scientific and technical word processing has become over the past 2 or 3 years.

Which is not to say that there aren't other good choices.

TWO ROUTES TO WP A longtime favorite, T^3 (known by its friends as "tee-cubed") has more little quirks than the U.S. Tax Code. It does its job very well, however, and in the process provides a very good on-screen display of the formu-

CONTRIBUTORS

Heeth Clark is general manager of Rhintek Inc., a systems software company that specializes in developing products and consulting in the areas of communications, compilers, editors, and graphics. She is also an instructor at Johns Hopkins University.

Henry Fersko-Weiss is a free-lance writer based in Warwick, New York. He is a regular contributor to several national publications.

Caroline Halliday is an electrical engineering consultant with High Tech Aid in Ellicott City, Maryland.

Alan Hoenig, who teaches mathematics at John Jay College in New York City, frequently writes about computer typesetting.

Patrick Nicholas, based in New York City, is a free-lance writer who frequently writes on computer-related topics.

Robin Raskin is a New York–based free-lance author, editor, and consultant specializing in computers. She writes frequently for *PC Magazine* and other computer publications.

Walt Rowinski is a free-lance technical writer based in Lakewood, Ohio.

Neil J. Rubenking is a contributing editor of *PC Magazine*.

Jim Seymour is a contributing editor of *PC Magazine*.

Richard Hale Shaw is a software engineer at Hilgraeve Inc., a Monroe, Michigan–based communications software vendor.

Kenneth H. Werner is the founder and owner of a Houston, Texas, information consultancy specializing in human factors and audits.

las you're entering. It's especially good for chemists who must reproduce chemical formulas on paper.

Comparing *Manuscript* and T^3 is illuminating because they represent two very different but very interesting approaches to meeting the needs of the scientific-technical word processing user.

Manuscript appears to be strictly character-oriented in text entry mode. Using color, you'll get a few clues indicating boldface or italic type, but the program is designed for rapid text entry and editing. Indeed, its text-handling speed approaches that of *XyWrite* and Version 4.0 of *Microsoft Word*, two of the fastest programs examined in our previous look at general-purpose word processing programs.

But if you try to see how your finished pages will look by slipping into *Manuscript*'s page-preview mode, you're in for a surprise: you'll discover that the program isn't character-oriented after all. On a graphics monitor you can slog through an incredibly slow page-by-page visual inspection of how the finished pages will look. Text is "greeked" (or simulated, with illegible squiggles), but if you wish you can blow up sections of the text to confirm (in simple stroke-font letters and numbers) that complex formulas have been entered properly.

T^3, by contrast, stays in graphics mode throughout the writing and editing process. Boldface, italic, underlining and strikethrough (and combinations of the above), as well as complicated multiline formulas, are shown on-screen as you work.

You pay a price, however, for that display: T^3 is much slower than *Manuscript* or the faster general-purpose word processing programs are at text entry and editing maneuvers.

NO MORE INDIA INK A very large percentage of scientific and technical papers, proposals, and manuscripts are still written by hand or typed very roughly on a typewriter or PC, then finally retyped by secretaries who leave blank spaces for symbols and complicated equations. Later, these symbols and equations are carefully inked in with a pen. Duplicate copies are made on a photocopier.

That's a shame—especially when the text of those papers originates on a PC running word processing software. Today, PC word processors are available that make text entry and editing fast and easy, allow authors to compose technical matter and formulas directly from the keyboard, and can insert graphs, illustrations, and even screened photos of lab apparatus or of the projects and phenomena described in the text.

As we see these dramatically improved PC-based word processing tools moving onto the PCs of scientists, engineers, and other technical personnel, with perhaps only a final cleanup and printout reserved for secretaries (who may, for example, have access to a fast laser printer), we're likely to see far fewer inked-in papers delivered at conferences and submitted to journals.

Those papers—and their mistakes, illegible numbers, and odd-looking symbols—won't be missed.—**Jim Seymour**

Alexander

Word processors gain popularity by coupling power with ease of use. Similarly, programs that offer power but are not easy to use often fall by the wayside. *Alexander*, from Design Enterprises of San Francisco, is a $245 personal word processor that has many useful features for scientists, mathematicians, composers, and anyone wanting to display foreign-language characters, but the way the features are implemented makes the program very difficult to use.

Written in compiled BASIC, *Alexander* will conquer you before you conquer

PC MAGAZINE FACT FILE

Alexander, Version B
Design Enterprises of San Francisco
P.O. Box 14695
San Francisco, CA 94114
(415) 282-8813
List Price: $245

Requires: 256K RAM, one disk drive, DOS 2.0 or later

In Short: A difficult, poorly implemented word processor that requires a keydisk. You can display mathematical equations and chemical symbols as well as music charts, but you wouldn't want to. Not copy protected.

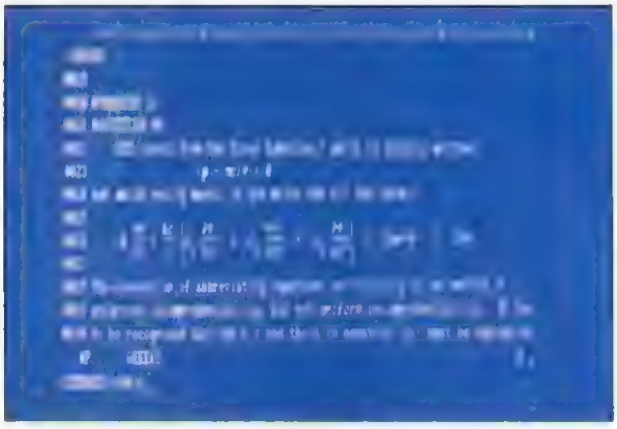
CIRCLE 643 ON READER SERVICE CARD

SEEKING THE RIGHT FORMULA

Broad character selection and flexible layout options are top priorities when choosing a scientific word processor. Here's how several programs present these features.

Alexander *lets you assemble mathematical or scientific equations on-screen. To create any additional symbols you require, you can use* Alexander's *character-generation program, which also allows you to remap the keyboard or mask unused letter keys.*

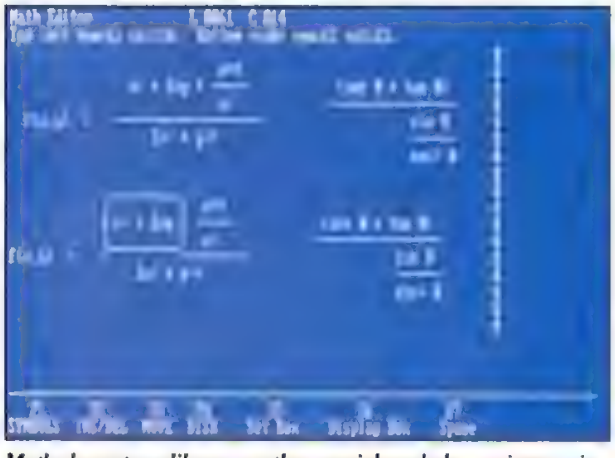
For editing text that includes formulas, **ChiWriter**'s *synchronized mode ensures that subscripted characters shift their position along with the rest of a formula. Here the letter* m *is added to the text, with the results shown in both modes.*



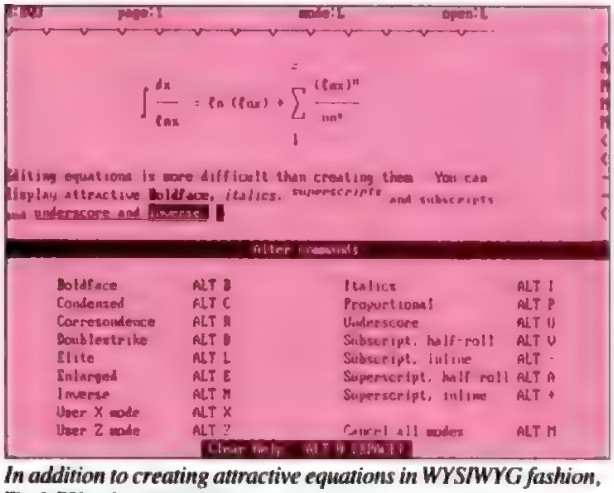
The Egg *keeps each equation on one line wherever possible and allows up to 17 levels in a single equation. The program's fonts contain an extensive variety of technical symbols; any other symbols may be created using a utility that comes with the software.*

The **EXP** *display, completely WYSIWYG, shows on its status line the mnemonics that produced the bracketed expression in the denominator of equation 1. To produce equation 2, more elements were added to equation 1.*

More a language and compiler than a text editor, **PCTeX** *accepts its commands for special symbols in a document prepared jointly with another word processor.*

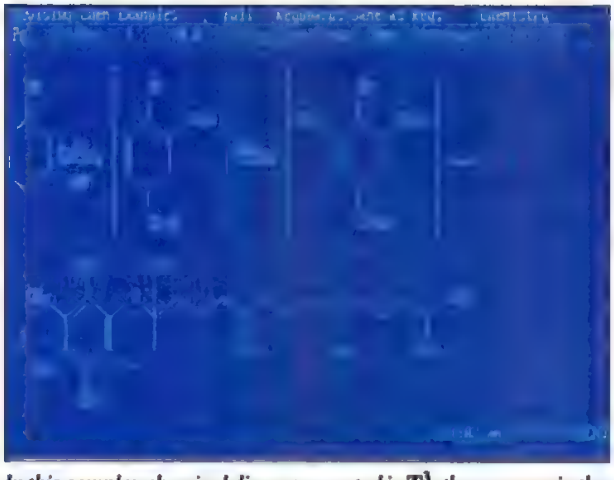


Math characters, like many other special symbols, are input using function keys in **Spellbinder Scientific.** *The program's math edit macro simplifies the entry and editing of a mathematical diagram.*

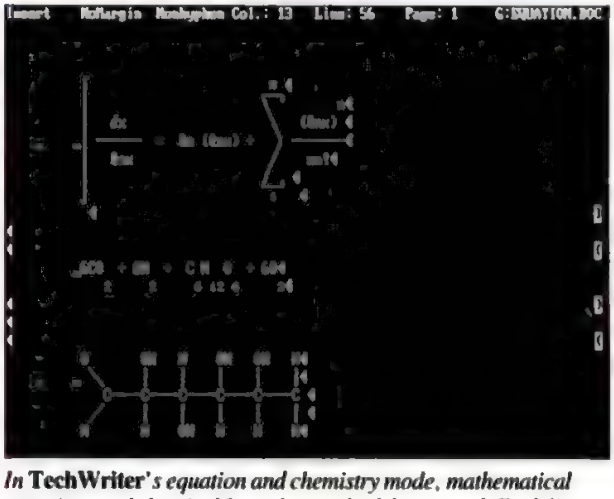


In addition to creating attractive equations in WYSIWYG fashion, **Tech/Word** *is WYSIWYG oriented in its text composition, displaying bold, italics, sub- and superscripts, underscore, and reverse video. Footers and headers are not WYSIWYG.*

Both text and equations in **PS** *are initially entered in the text mode, where the linear format for equations makes them easy to enter and read.*



In this complex chemical diagram created in **T³**, *the message in the top-left corner notes that a file called "Chem Examples" is being revised.* **T³** *allows filenames that DOS would not accept.*



In **TechWriter***'s equation and chemistry mode, mathematical equations and chemical formulas can both be entered. Each line on the screen represents a half line on the printer. Subscripts can also be printed a half-space wide to improve the look of the output.*

("Seeking the Right Formula" continued)

Once you open a file in **Total Word,** *you can access more than 400 scientific characters by calling up one of nine special on-screen keyboards. Often-used equations or the process of drawing compounds can be automated with macros.*

WordMarc Composer *has three technical character sets available: Greek, chemical, and DecTech. In addition, the conventional English alphabet can be modified with a few keystrokes to reflect European punctuation.*

it. The installation process makes you think that you can install it to and run it from a hard disk, but you quickly discover that no matter where you run it from, it requires a keydisk in drive A:. The first thing *Alexander* dislodges is your CONFIG .SYS file and, if you're not careful, your AUTOEXEC.BAT file, too.

Alexander works with a monochrome, CGA, or HerculesPlus video board. Although the screen resolution on a monochrome monitor is adequate for text display, you'll need a CGA monitor in order to see any of the extended ASCII characters. But although *Alexander* requires a CGA, it can't work in color—all you get is high-intensity white—and unfortunately, it won't recognize an EGA or VGA card.

Alexander is menu driven and has light-pen and mouse drivers to make choosing selections easier. The menus get to be intrusive because you have to use them to get anywhere.

FOUR MODULES *Alexander* has four modules: basic word processing, editing, printing, and a control program. The basic word-processing module is for creating documents containing up to 18 pages of double-spaced type. The editing program, which handles larger documents, has a file-chaining selection that lets you link files together, giving you the illusion of one document.

You can print most small documents (no longer than 18 pages) directly from the word processing and editing menus, but for larger jobs you have to go to the printing program. The control program takes care of the default values and the printer controls.

In addition, a character-generation program lets you create your own display characters, remap the keyboard, or mask unused letter keys. *Alexander* even has a typesetting module.

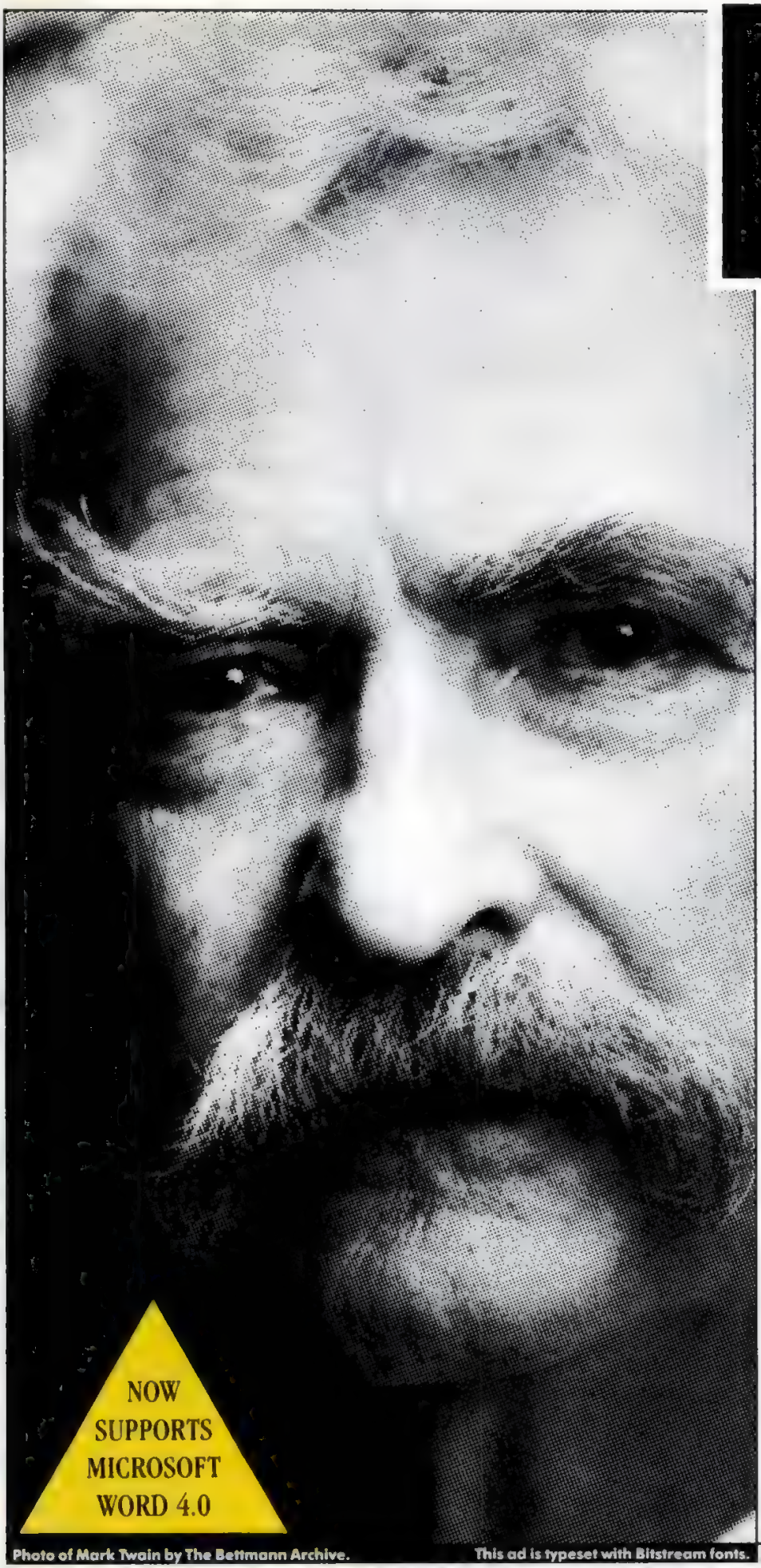
When you start the basic word processor, *Alexander* uses the standard defaults set out by the control program: line length is 65 characters, and tabs are set at every five stops. Line length can vary from 5 to 255 characters. *Alexander* saves to files and reads them in a text format that includes any special formatting codes. It can also read and write ASCII files directly.

Text formatting is shown on-screen with embedded characters identifying bold, underline, and super- and subscripts, among others. During editing you can do block moves, copy, delete, and search and replace. When you are in text-editing mode, *Alexander* changes the cursor from an unblinking underline character to a disconcerting, fluttering rectangle.

ALTERNATE CHARACTER SETS Word processing in another language is possible with *Alexander*, but not easy. You can remap the keyboard, no small task in itself, and write a glossary help screen to show you which keys have been changed; this screen replaces *Alexander*'s regular help display. None of these are simple operations. In order to use any special characters you first have to load the word processor, then load the special characters, return through the menus to load the glossary phrases, and, finally, you can begin typing.

Graphics character sets are available for music composition, mathematical and scientific equations, molecular charts, and electronic schematics. Cyrillic, Hebrew, Greek, and accents for most European languages are available, too. You can buy key decals in Cyrillic, Hebrew, and Greek, and if you type in Hebrew, it is possible to enter characters from right to left.

Multiline equations are done by first entering "graph paper" on the screen and then doing a character-by-character entry to build models that use more than one line. Music composition is entered in mu-



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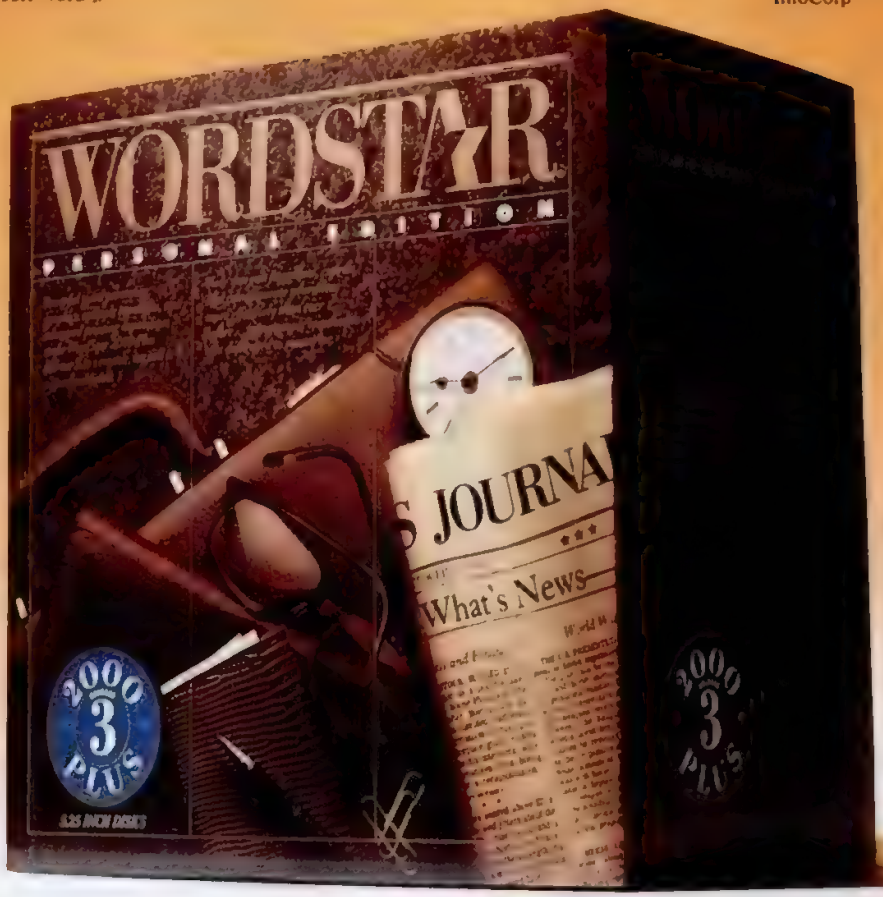

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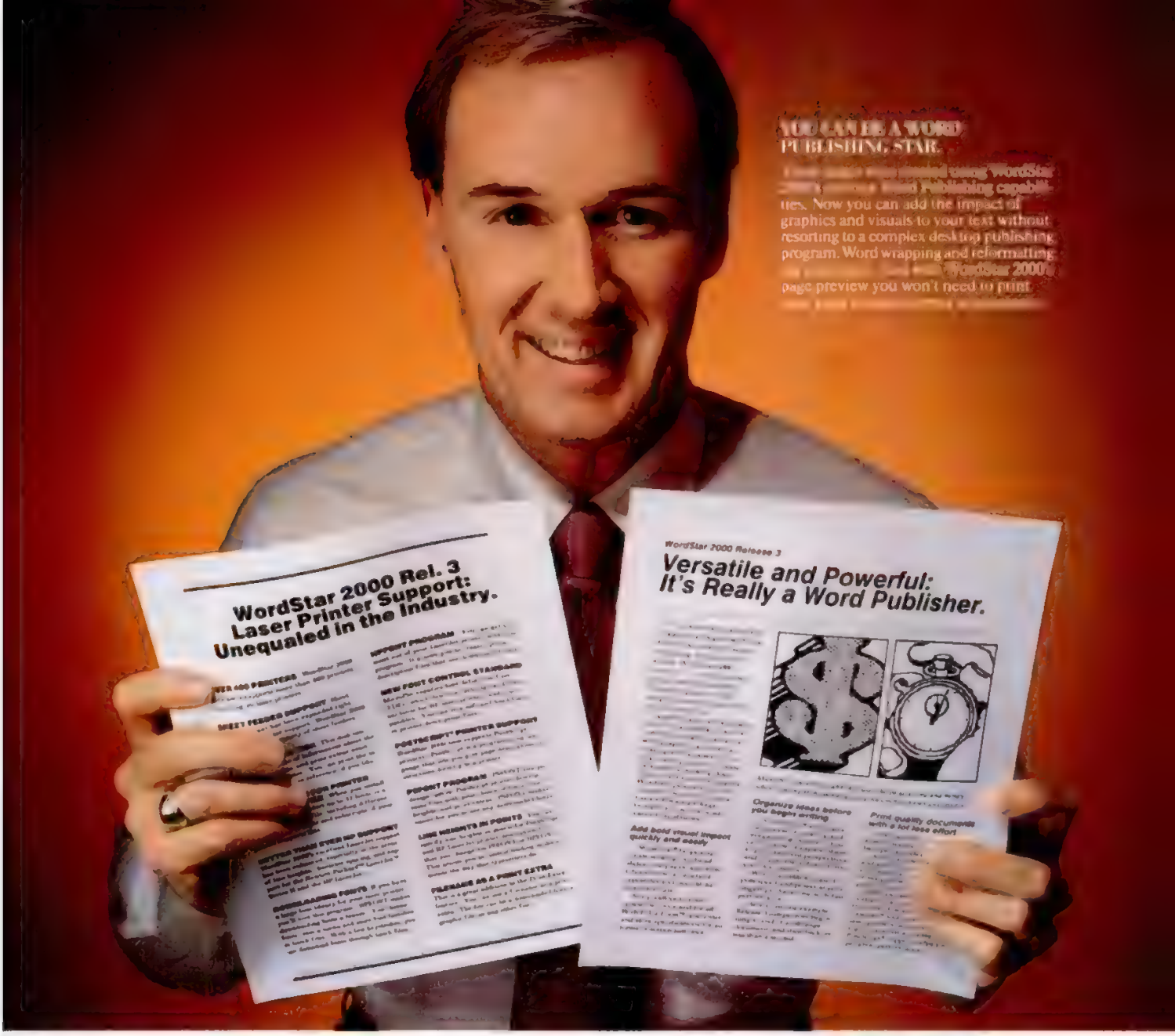
Technical Support	Excellent	Satisfactory	Good	Satisfactory
Support Policies	Excellent	Good	Good	Satisfactory
Value	Excellent	Excellent	Excellent	Satisfactory
Documentation	Excellent	Excellent	Excellent	Very Good
Speed	Good	Good	Good	Poor
Compatibility	Excellent	Satisfactory	Very Good	Excellent
Totals of all Categories	7.8	7.4	7.3	5.4

March 28, 1988 *InfoWorld* ranked WordStar 2000 as the top product.



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sic charts that *Alexander* conveniently paints to the screen. When you're in edit mode, you enter the notes, sharps, flats, and so on.

Alexander lets you do just about anything you want, but not easily. The package's shortcomings include its use of a keydisk and its repetitive, intrusive menus. There is at least one similarity between *Alexander* the word processor and Alexander the Great: it would not be worthwhile to tangle with either of them.

—Patrick Nicholas

ChiWriter

ChiWriter, from Horstmann Software Design Corp., is a scientific word processor that makes the processes of including mathematical symbols and line drawings within text and generating different fonts a snap. Editing formulas and equations is equally simple.

ChiWriter costs $79.95 for a base configuration that includes fonts for mathematical symbols, CGA compatibility, and printer drivers for 9-pin dot matrix printers. You'll have to spend an additional $24.95 for video drivers if you want Hercules, EGA, and VGA compatibility. Drivers for Hewlett-Packard LaserJet and PostScript printers cost $59.95, and those for other dot matrix printers cost $24.95. Fonts for chemistry symbols cost an additional $49.95.

ChiWriter can be installed on a single-floppy-disk-drive system with 256K RAM. A dual-floppy or hard disk system and 512K RAM are recommended for large word-processing jobs, however. The program does not come with a spelling checker or thesaurus. Horstmann Software reports that Version 3.0 of *ChiWriter* will sport a spelling checker and will also support PostScript printers.

SELECTING FONTS The program's function keys hold the secret to selecting fonts. Up to 20 fonts (italic, bold, math, line-drawing, Greek, Standard English, and others) are assigned to keys F1 through F10 and Shift-F1 through Shift-F10. Switching from one font to another is just a matter of selecting the appropriate function key to use.

The default font is Standard English, located at F1. To change from Standard English to the "small" font (an alphanumeric font suitable for sub- and superscripts), for example, you merely press F2 at the appropriate spot in your text. Press F2 once, and only the next character will be "small"; all characters thereafter will be printed in Standard English. Press F2 twice, and the "small" font remains active. And if you press a font-change key followed by Alt-H, *ChiWriter* will display a keyboard chart that tells you which key encodes which symbol.

When you activate a function key, the symbols appear on the screen in the selected font. With the exception of proportional spacing, *ChiWriter* offers WYSIWYG word processing.

The *ChiWriter* screen has four information lines. Across the top of the screen are the tab-ruler and mode line (which identify tab locations, the selected font, and the insert, spacing, and synchronization modes). Across the bottom of the screen are two rows of information: one a command line, the other a brief description of the selected command. You can hide this bottom portion if you wish to display more lines of text on-screen.

You issue editing commands either through the menu at the screen bottom or through Ctrl-key or Alt-key combinations. Marking text, moving text, wrapping words, selecting tabs, and searching both forward and backward are only a few of the commands that you can select using this method.

GENERATING SYMBOLS With *ChiWriter*, generating math and scientific symbols is a breeze. There are two math fonts and four scientific fonts that will give you just about any symbol you'll need. You can create special symbols by mixing the symbols or line-drawing fonts with the math fonts. Moreover, *ChiWriter's* Font Designer gives you added control over special symbols and characters, allowing you to edit two fonts at the same time or create a new symbol by cutting and pasting, painting, changing the width of the characters, or overlaying the character boxes of two edited fonts.

ChiWriter also makes it easy to write and edit formulas and equations. To obtain a sub- or superscript, you must employ a two-key command; *ChiWriter* moves the next character up or down one-half line space into the sub- or superscript row. Since symbols are shown correctly on the screen, errors are easy to spot.

ChiWriter shines in its edit mode, because it lets you control the spacing after inserting or deleting text. When inserting a character into an equation that includes sub- or superscripts, for example, you first press the synchronization toggle key (* on the numeric keypad) to switch into synchronization mode. In this mode, the sub- or superscript character moves aside—in its proper place beside the character preceding it—to accommodate the insertion. Otherwise the sub- or superscript would end up, respectively, beneath or above the character it was meant to follow.

On the downside, *ChiWriter* will not calculate the formulas that you enter. Lines cannot be longer than 80 characters. Footnotes, headers, footers, and endnotes are available, but footnotes cannot run across two pages.

All in all, *ChiWriter* is easy to use and provides WYSIWYG multisymbol capability that you won't find in many more-expensive word processors. The program is an excellent secondary word processor for users whose documents require specialized symbols and line drawings.

—Heeth Clark

PC MAGAZINE FACT FILE

***ChiWriter*, Version 2.5**
Horstmann Software Design Corp.
140 E. San Carlos, #200
P.O. Box 5039
San Jose, CA 95150
(408) 298-0828
List Price: $79.95; video drivers for Hercules, EGA, VGA, $24.95; drivers for HP LaserJet and PostScript printers, $59.95; drivers for printers other than 9-pin, $24.95.
Requires: 256K RAM, one disk drive, DOS 2.0 or later.
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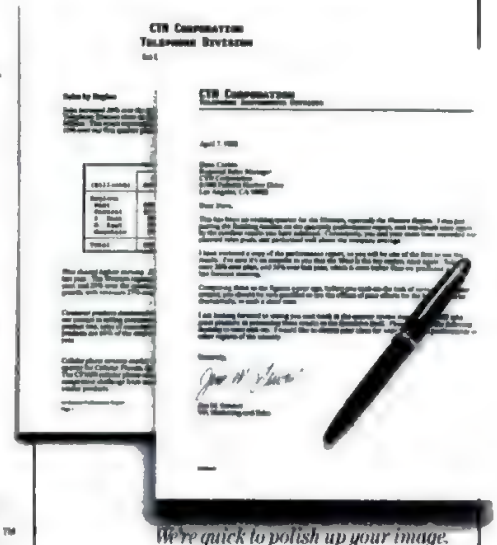
You no longer have to spend your valuable time hunting down files. Our new *File-Finder* searches through the actual text of *all* your Professional Write files to find any words or phrase, and will call up the appropriate document. We'll also give you sorted lists of files, and the option to identify your files with summary descriptions.

There's more to our feature story.

We know what managers need from a word processor. That's why Professional Write offers speed keys, macros, and column-move. An integrated spelling checker,



We're quick to polish up your image.

thesaurus, on-screen calculator and address book are only a keystroke away. We also support all the popular networks.

Put time on your side. Call 1-408-848-4391, Operator #60 for a free trial disk.

PFS: Professional Write and PFS: Write owners Call 1-800-255-5550 for upgrade information.

SPC SOFTWARE PUBLISHING CORPORATION

The designers of PFS.

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Scientific and Technical Word Processors: Summary of Features

(Products listed in ascending price order)

Product name	Tech/Word	ChiWriter	EXP	Alexander	WordMarc Composer	PS
List price	$75.00	$79.95	$150.00	$245.00	$375.00	$395.00
Price of upgrade	Free	$10.00	$25.00	Free	$149.00	$40.00
Network version						
Cost of master program	N/A	N/A	N/A	N/A	$695	N/A
No. of users license allows	N/A	N/A	N/A	N/A	1	N/A
Cost per additional user	N/A	N/A	N/A	N/A	$150	N/A
Site license available	○	○	○	○	●	●
Memory usage						
Expanded memory	○	○	○	○	○	○
Extended memory	○	○	○	○	○	○
Disk usage						
Disk space required	350K	150K	110K	440K	1,500K	403K
Program is entirely memory resident	○	●	●	○	○	○
Text formatting features						
Left justification	●	●	●	●	●	●
Center justification	○	○	●	○	○	●
Right justification	○	○	●	○	●	●
Proportional spacing	○	●	●	○	●	●
Adjustable left and right margins	●	●	●	●	●	●
Maximum right margin setting	255	78	132	254	163	250
Maximum no. of margin changes per document	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Block indent (left)	●	○	○	○	●	●
Block indent (left and right)	○	○	○	○	○	○
1½-line spacing	●	●	●	●	●	●
Double line spacing	●	●	●	●	●	●
Triple line spacing	●	●	●	●	●	●
Auto-leading	○	○	●	○	○	○
Variable line spacing within document	●	●	●	●	●	●
10 characters per inch	●	●	○	●	●	●
12 characters per inch	○	●	○	●	●	●
Compressed type	○	●	○	●	●	●
Additional monospace pitches	○	○	○	●	●	●
On-screen underline	●	●	●	○	●	●
On-screen bold	●	●	●	○	●	●
Continuous underline	●	○	●	●	●	●
Broken underline	○	●	●	●	○	○
Double underline	○	○	●	○	○	●
Superscripts	●	●	●	●	●	●
Subscripts	●	●	●	●	●	●
Italics	●	●	●	●	○	●
Bold italics	●	●	●	●	○	●
Overstrike	○	○	●	●	●	●
Strikethrough	○	○	●	●	○	○
Small capitals	○	●	●	○	○	●
Nonprinting notes replaced by blanks	○	○	○	○	●	●
Nonprinting notes with space closed up	○	○	○	○	○	○
Adjustable top and bottom margins	●	●	●	●	●	●
Maximum page length (lines)	Unlimited	9,999	66	Unlimited	Unlimited	Unlimited
Variable page length within document	●	○	●	●	●	●
Vertical centering	○	○	○	○	○	○
Tabs can be entered anywhere	●	●	●	●	●	●
Tabs move when left margin changes	○	○	●	●	○	○

PC—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable; program does not have this feature.

*For 2 to 15 users, $150 each, 16 to 30 users, $100 each; 31 or more, $50 each. Add $50 to each number for previewer and laser driver support.

Product name	TechWriter	The Egg	Total Word	PCTeX	T³	Spellbinder Scientific
List price	$395.00	$495.00	$495.00	$499.00	$595.00	$790.00
Price of upgrade	$50.00	$50.00	$99.00	$50.00	$145.00	$295.00
Network version						
Cost of master program	N/A	N/A	N/A	$599	N/A	N/A
No. of users license allows	N/A	N/A	N/A	1	N/A	N/A
Cost per additional user	N/A	N/A	N/A	$150*	N/A	N/A
Site license available	○	●	○	●	○	○
Memory usage						
Expanded memory	○	○	○	○	○	○
Extended memory	○	○	○	○	○	○
Disk usage						
Disk space required	234K	256K	2.5MB	3MB	3MB	700K
Program is entirely memory resident	○	○	○	○	○	○
Text formatting features						
Left justification	●	●	●	●	●	●
Center justification	●	○	●	●	●	●
Right justification	●	●	●	●	●	●
Proportional spacing	●	●	●	●	●	●
Adjustable left and right margins	●	●	●	●	●	●
Maximum right margin setting	126	200	250	Unlimited	158	159
Maximum no. of margin changes per document	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Block indent (left)	●	●	●	●	●	●
Block indent (left and right)	●	○	●	●	○	●
1½-line spacing	●	●	●	●	●	●
Double line spacing	●	●	●	●	●	●
Triple line spacing	●	●	●	●	●	●
Auto-leading	○	●	○	●	○	●
Variable line spacing within document	●	●	●	●	●	●
10 characters per inch	●	●	●	●	●	●
12 characters per inch	●	●	●	●	●	●
Compressed type	○	●	●	●	●	●
Additional monospace pitches	○	●	●	●	●	●
On-screen underline	○	●	●	●	●	●
On-screen bold	●	●	●	●	●	●
Continuous underline	●	●	●	●	●	●
Broken underline	●	●	●	●	●	●
Double underline	○	●	○	●	○	○
Superscripts	●	●	●	●	●	●
Subscripts	●	●	●	●	●	●
Italics	●	●	●	●	●	●
Bold italics	●	●	●	●	●	●
Overstrike	●	●	●	●	●	●
Strikethrough	●	●	●	●	●	●
Small capitals	●	●	○	●	●	●
Nonprinting notes replaced by blanks	○	●	○	○	●	○
Nonprinting notes with space closed up	○	○	●	●	○	○
Adjustable top and bottom margins	●	●	●	●	●	●
Maximum page length (lines)	255	Unlimited	150	302	Unlimited	88
Variable page length within document	●	●	●	●	●	●
Vertical centering	○	●	○	●	○	○
Tabs can be entered anywhere	●	●	●	●	●	●
Tabs move when left margin changes	○	○	○	●	○	●

(continues)

Scientific and Technical Word Processors: Summary of Features

(Products listed in ascending price order)

Product name	Tech/Word	ChiWriter	EXP	Alexander	WordMarc Composer	PS
List price	$75.00	$79.95	$150.00	$245.00	$375.00	$395.00
Price of update	Free	$10.00	$25.00	Free	$149.00	$40.00
Text formatting features						
Maximum no. of tab stops	255	Unlimited	16	Unlimited	Unlimited	16
Hard page breaks	●	●	●	●	●	●
Conditional page breaks	●	○	●	●	○	●
Paragraphs can be linked	○	○	○	●	○	●
Unbreakable blocks	●	○	○	●	○	●
Widow control	○	○	○	●	●	○
Orphan control	○	○	○	●	●	●
Automatic page numbering	●	●	●	●	●	●
Automatic resetting of page numbers	●	●	●	●	●	●
Creates headers	●	●	●	●	●	●
Creates footers	●	○	●	●	●	●
Command strategy						
Full-screen menus	○	○	○	●	●	○
Partial-screen menus	●	○	○	○	●	●
Lotus-style menus	○	●	○	○	○	●
Can bypass menus	○	●	N/A	○	●	○
Command line	○	●	●	○	○	●
Function keys used with Alt/Shift/Ctrl	●	●	●	●	●	○
Alphanumeric keys used with Alt/Ctrl	●	●	●	●	○	●
Permanent defaults	○	●	●	●	●	●
Temporary defaults	●	●	●	●	●	●
Screen displays						
Screen displays ruler line	●	●	○	○	●	○
Ruler line can be suppressed	○	○	N/A	N/A	●	N/A
Ruler/status line shows character columns	○	●	○	○	●	●
Margin positions are graphically displayed	●	●	○	○	●	○
Ruler/status line shows line number	○	●	●	●	○	●
Ruler/status line shows page number	●	●	●	○	○	○
Ruler/status line shows filename	●	●	●	○	○	●
Program shows current drive and path	○	○	○	●	●	●
Ruler line shows DOS date and/or time	○	○	N/A	N/A	○	N/A
Page breaks are shown while typing	○	●	●	○	○	○
Paragraph markers are normally shown	●	●	○	●	○	○
Text entry and editing						
Status messages indicate special typing modes	●	●	○	●	●	●
Insert and overstrike modes are available	●	●	●	●	●	●
Deleting						
Entire word	●	●	●	○	○	●
Entire line	●	●	●	●	○	○
Sentence	○	○	○	○	○	○
Paragraph	●	○	○	○	○	○
Page	○	○	○	○	○	○
Column	○	○	○	○	●	○
Undelete capability	●	○	●	○	●	●
Multiple undelete levels	○	N/A	○	N/A	○	○
Mouse-controllable cursor	○	○	○	●	○	○
Word block	●	●	○	○	○	●
Line block	●	●	●	●	○	●
Sentence block	○	○	○	○	○	●

—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable; program does not have this feature

Product name	TextWriter	The Egg	PC Total Word	PCTeX	PC T	SpellBinder Scientific
List price	$395.00	$495.00	$495.00	$499.00	$595.00	$795.00
Price of upgrade	$50.00	$50.00	[illegible]	$50.00	$145.00	$295.00
Text formatting features						
Maximum no. of tab stops	Unlimited	200	250	Unlimited	Unlimited	Unlimited
Hard page breaks	●	●	●	●	●	●
Conditional page breaks	○	○	●	●	○	●
Paragraphs can be linked	○	○	●	○	○	○
Unbreakable blocks	●	○	●	●	○	●
Widow control	○	○	●	●	○	●
Orphan control	○	○	●	●	○	●
Automatic page numbering	●	●	●	●	●	●
Automatic resetting of page numbers	●	○	●	●	●	●
Creates headers	●	●	●	●	●	●
Creates footers	●	●	●	●	●	●
Command strategy						
Full-screen menus	○	○	●	○	○	○
Partial-screen menus	●	○	●	○	●	○
Lotus-style menus	○	○	○	○	○	●
Can bypass menus	●	N/A	○	N/A	●	○
Command line	●	●	○	●	○	●
Function keys used with Alt/Shift/Ctrl	●	●	●	○	●	○
Alphanumeric keys used with Alt/Ctrl	●	●	○	○	○	○
Permanent defaults	●	●	●	○	●	●
Temporary defaults	○	●	●	●	●	●
Screen displays						
Screen displays ruler line	○	●	●	●	●	○
Ruler line can be suppressed	N/A	○	●	●	●	N/A
Ruler/status line shows character columns	●	●	●	○	●	○
Margin positions are graphically displayed	○	●	●	○	●	○
Ruler/status line shows line number	●	●	●	○	●	●
Ruler/status line shows page number	●	●	●	○	●	○
Ruler/status line shows filename	●	○	●	○	●	○
Program shows current drive and path	●	○	●	●	○	○
Ruler line shows DOS date and/or time	N/A	○	●	○	●	N/A
Page breaks are shown while typing	●	●	●	○	○	●
Paragraph markers are normally shown	●	○	○	○	●	○
Text entry and editing						
Status messages indicate special typing modes	●	●	●	○	●	●
Insert and overstrike modes are available	●	●	●	○	●	●
Deleting						
Entire word	●	●	●	○	○	●
Entire line	●	●	●	○	○	○
Sentence	●	○	○	○	○	●
Paragraph	●	○	○	○	○	●
Page	○	●	○	○	○	○
Column	●	●	○	○	○	○
Undelete capability	●	●	●	○	○	●
Multiple undelete levels	●	○	●	N/A	N/A	○
Mouse-controllable cursor	○	○	○	○	○	○
Word block	●	○	●	○	○	●
Line block	●	○	●	○	○	○
Sentence block	●	○	○	○	○	●

(continued)

The Diconix 150 printer. Completes The silent partner

most any system. Quietly.
that fits in a briefcase.

DICONIX
A Kodak Company

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1-800-DICONIX

CIRCLE 241 ON READER SERVICE CARD

Scientific and Technical Word Processors: Summary of Features

(Products listed in ascending price order)

Product name	Tech/Word	ChiWriter	EXP	Alexander	WordWare Composer	PS
List price	$75.00	$79.95	$150.00	$245.00	$375.00	$395.00
Price of update	Free	$10.00	$25.00	Free	$149.00	$40.00
Text entry and editing						
Paragraph block	●	●	○	●	○	●
Column block	○	●	○	○	●	○
Page block	○	○	○	○	○	○
Block can be extended	○	○	●	●	○	○
Move block	●	●	●	●	●	●
Copy block	●	●	●	●	●	●
Delete block	●	●	●	●	●	●
Reformats automatically after block move	●	○	●	○	●	●
Copies or moves to another window	○	○	○	○	○	●
Copies or moves to and from footnotes	○	●	●	○	●	●
Saves to a file	●	●	●	●	●	●
Appends to a separate file	○	●	○	●	○	●
Search-and-replace						
Works forward and backward	○	●	○	○	●	●
Verifies replace	●	●	●	●	●	○
Searches within other files	○	○	○	●	○	○
Performs case-sensitive search	●	●	●	●	○	○
Preserves case when replacing	○	○	○	●	○	○
Recognizes whole words	○	○	○	●	○	●
Uses wildcards	○	○	○	○	○	●
Search-and-replace for format codes	●	○	○	●	●	●
Text windows						
No. of windows	N/A	2	4	N/A	N/A	3
Split-screen windows	N/A	●	●	N/A	N/A	○
Full-screen windows	N/A	○	●	N/A	N/A	●
Printer						
No. of printer drivers	20	33	5	15	171	12
Can modify printer drivers	●	●	○	●	●	●
Can work with more than one printer	○	●	○	●	●	○
Edits while printing	○	○	○	○	●	○
Queues documents for printing	○	○	○	○	●	○
Can change print queue	○	○	○	○	●	○
Prints block	○	●	○	●	○	○
Prints continuous range of pages	●	●	●	●	●	●
Prints selected pages	○	○	○	○	○	●
Prints as you type	○	○	○	○	○	●
Higher-order ASCII characters	●	●	●	●	●	●
Automatic envelope formatting and printing	○	○	○	●	○	●
Landscape mode	○	○	○	●	○	○
File handling						
Entire document kept in RAM	●	●	●	●	○	●
Maximum file size	Unlimited	160K	Unlimited	1.82MB	Unlimited	50K
Creates .BAK file	●	○	●	○	●	●
Makes backup during save and resume	○	●	○	○	○	●
Temporarily goes to DOS	○	○	●	○	●	○
Includes file management functions	●	○	○	●	●	●
Can search disk for a filename	○	○	○	○	●	○
File import/export						
Accepts DCA files	○	○	○	○	●	○
Accepts *WordStar* files	○	●	○	○	●	○
Accepts *WordPerfect* files	○	●	○	○	●	○

PC—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable; program does not have this feature.

Product name	TechWriter	The Egg	PC Total Word	PCTeX	PC T³	Spellbinder Scientific
List price	$395.00	$495.00	$495.00	$499.00	$595.00	$790.00
Price of upgrade	$50.00	$50.00	$99.00	$50.00	$145.00	$295.00
Text entry and editing						
Paragraph block	●	○	○	○	○	●
Column block	●	○	○	○	○	●
Page block	●	○	○	○	○	○
Block can be extended	●	○	○	○	●	○
Move block	●	●	●	○	●	●
Copy block	●	●	●	○	●	●
Delete block	●	●	●	○	●	●
Reformats automatically after block move	●	○	●	○	●	○
Copies or moves to another window	○	○	●	○	○	○
Copies or moves to and from footnotes	●	○	●	○	●	○
Saves to a file	●	○	●	○	○	●
Appends to a separate file	○	●	●	○	○	○
Search-and-replace						
Works forward and backward	●	●	●	N/A	○	●
Verifies replace	●	○	●	N/A	●	●
Searches within other files	○	○	●	N/A	○	○
Performs case-sensitive search	●	●	●	N/A	●	●
Preserves case when replacing	○	○	●	N/A	○	○
Recognizes whole words	●	○	●	N/A	○	●
Uses wildcards	○	○	●	N/A	○	●
Search-and-replace for format codes	●	●	●	N/A	●	○
Text windows						
No. of windows	N/A	N/A	2	N/A	N/A	N/A
Split-screen windows	N/A	N/A	●	N/A	N/A	N/A
Full-screen windows	N/A	N/A	○	N/A	N/A	N/A
Printer						
No. of printer drivers	102	8	200	12	10	5
Can modify printer drivers	○	○	●	○	○	○
Can work with more than one printer	○	●	●	●	●	○
Edits while printing	●	○	●	○	○	○
Queues documents for printing	○	○	●	○	●	○
Can change print queue	○	○	●	○	○	○
Prints block	○	●	●	○	○	●
Prints continuous range of pages	●	●	●	●	●	●
Prints selected pages	●	○	○	●	●	○
Prints as you type	○	○	●	○	○	○
Higher-order ASCII characters	○	○	●	●	●	○
Automatic envelope formatting and printing	●	○	●	○	○	○
Landscape mode	●	●	●	●	●	●
File handling						
Entire document kept in RAM	○	○	●	○	○	○
Maximum file size	1MB	173K	1MB	Unlimited	Unlimited	Unlimited
Creates .BAK file	●	○	●	○	○	●
Makes backup during save and resume	●	○	●	○	○	●
Temporarily goes to DOS	○	●	●	●	○	●
Includes file management functions	●	○	●	○	●	●
Can search disk for a filename	○	○	●	●	●	○
File import/export						
Accepts DCA files	○	○	○	○	○	○
Accepts *WordStar* files	○	●	○	○	○	●
Accepts *WordPerfect* files	○	○	○	○	○	○

(continues)

"What am I doing here?"

I guess I have a reputation for saying what's on my mind. So when the people at Everex asked me to be in their ad, I said it was okay as long as they let me have the floor.

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CIRCLE 216 ON READER SERVICE CARD

"At 20MHz this is the fastest beast I've ever had the pleasure to meet."

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Columnist, PC Magazine

IBM PS/2 Model 80 (20 MHz)	3.52 MIPS
Compaq DeskPro 386/20	4.59 MIPS
Everex Step 386/20	4.91 MIPS

Power Meter MIPS Version 1.2. The Database Group.

EVEREX
STEP

Scientific and Technical Word Processors: Summary of Features

(Products listed in ascending price order)

Product name	Tech/Word	ChiWriter	EXP	Alexander	WordMarc Composer	PS
List price	$75.00	$79.95	$150.00	$245.00	$375.00	$395.00
Price of update	Free	$10.00	$25.00	Free	$149.00	$40.00
File handling						
Accepts *Microsoft Word* files	○	○	○	○	●	○
Accepts *MultiMate* files	○	○	○	○	●	○
Spelling checker, hyphenation, thesaurus						
Spelling checker	○	○	○	○	●	○
No. of words in standard dictionary	N/A	N/A	N/A	N/A	60,000	N/A
Dictionary size	N/A	N/A	N/A	N/A	421K	N/A
Dictionary developer	N/A	N/A	N/A	N/A	In-house	N/A
No. of user-defined dictionaries	N/A	N/A	N/A	N/A	Unlimited	N/A
Spell-checks single word	N/A	N/A	N/A	N/A	○	N/A
Spell-checks defined block	N/A	N/A	N/A	N/A	○	N/A
Check-as-you-type option	N/A	N/A	N/A	N/A	○	N/A
Hyphenation						
Based on algorithm or dictionary	N/A	N/A	N/A	N/A	Both	Algorithm
Uses hot zone for hyphenation	○	○	○	○	●	●
Inserts soft hyphens	○	○	○	○	●	●
Allows entering soft hyphens from keyboard	○	○	●	○	●	●
Readjusts to additions and deletions	○	○	●	○	●	●
Thesaurus	○	○	○	○	○	○
Antonyms provided	N/A	N/A	N/A	N/A	N/A	N/A
Manuscript preparation						
Footnote/endnote capability	○	●	●	●	●	●
Different fonts	N/A	○	○	○	○	●
Auto-numbering	N/A	●	●	●	●	●
Indexing capability	○	○	○	○	●	●
Multilevel indexing	N/A	N/A	N/A	N/A	●	●
Table of contents	○	○	○	○	●	●
Multilevel formats	N/A	N/A	N/A	N/A	●	○
Desktop publishing features						
Snaking columns	○	○	●	○	○	●
Single and snaking columns on same page	N/A	N/A	●	N/A	N/A	●
Maximum no. of columns	N/A	N/A	9	N/A	N/A	Unlimited
Full justification and microjustification	N/A	N/A	●	N/A	N/A	●
Automatic calculation of placement and width	N/A	N/A	●	N/A	N/A	●
Side-by-side columns	○	○	○	○	○	●
Maximum no. of columns	N/A	N/A	N/A	N/A	N/A	Unlimited
Full justification and microjustification	N/A	N/A	N/A	N/A	N/A	●
Unmatched column widths available	N/A	N/A	○	N/A	N/A	●
Adjustable gutter width	N/A	N/A	○	N/A	N/A	●
Single column automatically restored	N/A	N/A	○	N/A	N/A	●
Line graphics	●	●	○	●	○	●
Erasable line graphics	●	●	○	○	○	●
Dynamic graphics	●	○	○	○	○	●
Ability to import graphics-format files	○	●	○	○	●	●
Graphics preview	●	○	○	○	○	●
Page preview	○	○	○	○	●	●
Full-page vertical monitor supported	○	○	○	○	●	●
Landscape high-resolution monitor supported	○	○	○	○	●	○
Zoom image	○	○	○	○	○	○

PC—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable; program does not have this feature.

Product name	TextWriter	The Egg	Total Word (PC)	PCTeX	T³ (PC)	Spellbinder Scientific
List price	$395.00	$495.00	$495.00	$499.00	$595.00	$790.00
Price of upgrade	$50.00	$50.00	$99.00	$50.00	$145.00	$225.00
File handling						
Accepts *Microsoft Word* files	○	○	○	○	○	○
Accepts *MultiMate* files	○	○	○	○	○	○
Spelling checker, hyphenation, thesaurus						
Spelling checker	Optional ($50)	○	●	○	●	●
No. of words in standard dictionary	123,000	N/A	170,000	N/A	80,000	50,000
Dictionary size	347	N/A	150K	N/A	185K	112K
Dictionary developer	In-house	N/A	In-house	N/A	Trigram Systems	Merriam-Webster
No. of user-defined dictionaries	1	N/A	1	N/A	Unlimited	1
Spell-checks single word	○	N/A	●	N/A	●	○
Spell-checks defined block	○	N/A	●	N/A	●	○
Check-as-you-type option	○	N/A	○	N/A	●	○
Hyphenation						
Based on algorithm or dictionary	Algorithm	N/A	Both	Algorithm	N/A	Dictionary
Uses hot zone for hyphenation	○	○	●	○	●	●
Inserts soft hyphens	●	○	●	●	●	●
Allows entering soft hyphens from keyboard	●	●	●	○	●	●
Readjusts to additions and deletions	●	○	●	●	●	○
Thesaurus	○	○	●	○	○	○
Antonyms provided	N/A	N/A	●	N/A	N/A	N/A
Manuscript preparation						
Footnote/endnote capability	●	●	●	●	●	○
Different fonts	○	●	●	●	●	N/A
Auto-numbering	●	○	●	●	●	N/A
Indexing capability	●	○	●	●	○	○
Multilevel indexing	●	N/A	●	●	N/A	N/A
Table of contents	●	○	●	●	○	○
Multilevel formats	○	N/A	●	●	N/A	N/A
Desktop publishing features						
Snaking columns	●	○	●	○	●	○
Single and snaking columns on same page	○	N/A	●	N/A	●	N/A
Maximum no. of columns	Unlimited	N/A	19	N/A	9	N/A
Full justification and microjustification	●	N/A	●	N/A	●	N/A
Automatic calculation of placement and width	○	N/A	●	N/A	○	N/A
Side-by-side columns	○	●	○	●	●	●
Maximum no. of columns	N/A	5	N/A	2	9	2
Full justification and microjustification	N/A	●	N/A	●	●	●
Unmatched column widths available	○	●	○	●	●	○
Adjustable gutter width	○	○	○	●	●	○
Single column automatically restored	○	●	○	○	●	●
Line graphics	●	○	●	●	●	○
Erasable line graphics	○	○	●	○	●	○
Dynamic graphics	○	○	○	○	○	○
Ability to import graphics-format files	○	○	○	○	●	○
Graphics preview	○	●	●	○	○	○
Page preview	○	○	●	●	○	●
Full-page vertical monitor supported	○	○	●	●	●	○
Landscape high-resolution monitor supported	○	○	○	○	○	○
Zoom image	○	○	○	○	○	○

(continues)

Scientific and Technical Word Processors: Summary of Features

(Products listed in ascending price order)

Product name	Tech/Word	CbWriter	EXP	Alexander	WordMarc Composer	PE
List price	$70.00	$79.95	$150.00	$245.00	$375.00	$395.00
Price of update	Free	$10.00	$25.00	Free	$149.00	$40.00
Desktop publishing features						
Compatible with:						
Bylines	○	○	○	○	○	○
GEM Desktop Publisher	○	○	○	○	○	○
The Office Publisher	○	○	○	○	○	○
PageMaker	○	○	○	○	○	○
Ventura Publisher	○	○	○	○	○	○
Scientific and technical features						
Supports oversize fonts	●	●	●	●	●	●
Displays symbols not in IBM's character set	●	●	●	●	●	●
Numeric features						
Performs arithmetic	○	○	○	○	○	○
Keyboard calculations	N/A	N/A	N/A	N/A	N/A	N/A
Keyboard calculations can be dropped into text	N/A	N/A	N/A	N/A	N/A	N/A
Calculates from numbers on the screen	N/A	N/A	N/A	N/A	N/A	N/A
Pop-up calculator	N/A	N/A	N/A	N/A	N/A	N/A
Equation-processing mode						
Equation solving	○	○	○	○	○	○
Imports equations	○	○	○	○	○	○
Aligns portions of equations	●	●	●	●	○	○
Auto carriage returns	○	○	○	●	○	○
Auto entry and exit	○	○	○	●	○	○
Can copy or move equations	●	●	●	○	○	○
Can copy or move column areas of equations	○	○	●	○	○	○
Supports Goto Parenthesis command	○	○	○	○	○	○
Reads/imports *Lotus 1-2-3* files	○	○	○	○	○	○
Corporate and professional features						
Mail-merge	○	○	○	○	●	●
Maximum no. of record files	N/A	N/A	N/A	N/A	Unlimited	Unlimited
Mailing labels printed	N/A	N/A	N/A	N/A	●	●
Group editing and file comparison						
Revision marking	○	○	○	○	○	○
Changes verified one by one	N/A	N/A	N/A	N/A	N/A	N/A
File comparison	○	○	○	○	○	○
Outline numbering	○	○	○	○	○	○
No. of outline levels supported	N/A	N/A	N/A	N/A	N/A	N/A
Collapsible outlines	N/A	N/A	N/A	N/A	N/A	N/A
Telecommunications module	○	○	○	●	●	○
Legal features						
Creates table of authorities	○	○	○	○	●	○
Checks citation formats	○	○	○	○	○	○
Provides line numbering	○	○	○	○	○	○
Other corporate features						
Passwords	○	○	○	○	○	○
File encryption	○	○	○	○	●	○
Preformatted forms processing	○	○	○	○	●	●

PC—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable; program does not have this feature.

Product name	TechWriter	The Egg	PC Total Word	PCTeX	PC T³	Spellbinder Scientific
List price	$395.00	$495.00	$495.00	$499.00	$595.00	$790.00
Price of upgrade	$50.00	$50.00	$99.00	$50.00	$145.00	$295.00
Desktop publishing features						
Compatible with:						
Bylines	○	○	●	○	○	○
GEM Desktop Publisher	○	○	●	○	○	○
The Office Publisher	○	○	●	○	○	○
PageMaker	○	○	●	○	○	○
Ventura Publisher	○	○	●	○	○	○
Scientific and technical features						
Supports oversize fonts	●	●	●	●	●	●
Displays symbols not in IBM's character set	●	●	●	●	●	●
Numeric features						
Performs arithmetic	○	○	●	○	○	●
Keyboard calculations	N/A	N/A	○	N/A	N/A	●
Keyboard calculations can be dropped into text	N/A	N/A	N/A	N/A	N/A	●
Calculates from numbers on the screen	N/A	N/A	●	N/A	N/A	●
Pop-up calculator	N/A	N/A	○	N/A	N/A	○
Equation-processing mode						
Equation solving	○	○	○	○	○	○
Imports equations	○	○	○	○	○	○
Aligns portions of equations	●	●	●	●	●	○
Auto carriage returns	●	●	●	○	○	○
Auto entry and exit	○	●	○	○	○	○
Can copy or move equations	●	●	●	○	●	○
Can copy or move column areas of equations	●	●	●	○	●	○
Supports Goto Parenthesis command	○	○	○	○	○	○
Reads/imports *Lotus 1-2-3* files	○	○	○	○	○	●
Corporate and professional features						
Mail-merge	●	○	●	●	●	●
Maximum no. of record files	Unlimited	N/A	Unlimited	Unlimited	Unlimited	1
Mailing labels printed	●	N/A	●	●	●	●
Group editing and file comparison						
Revision marking	○	○	●	○	○	○
Changes verified one by one	N/A	N/A	●	N/A	N/A	N/A
File comparison	○	○	○	○	○	○
Outline numbering	○	○	○	●	○	○
No. of outline levels supported	N/A	N/A	N/A	Unlimited	N/A	N/A
Collapsible outlines	N/A	N/A	N/A	○	N/A	N/A
Telecommunications module	○	○	○	○	○	○
Legal features						
Creates table of authorities	○	○	○	○	○	○
Checks citation formats	○	○	○	○	○	○
Provides line numbering	○	●	●	●	○	●
Other corporate features						
Passwords	●	○	○	○	●	○
File encryption	○	○	○	○	○	○
Preformatted forms processing	○	○	●	●	○	○

(continues)

Scientific and Technical Word Processors: Summary of Features

(Products listed in ascending price order)

Product name	Tech/Word	ChiWriter	EXP	Alexander	WordMarc Composer	PS
List price	$75.00	$79.95	$150.00	$245.00	$375.00	$395.00
Price of update	Free	$10.00	$25.00	Free	$149.00	$40.00
Macros and sort routines						
No. of macros	N/A	50	Unlimited	48	Unlimited	350
Includes sort routines	○	○	○	○	○	○
User can elect fields for sorting	N/A	N/A	N/A	N/A	N/A	N/A
Help, documentation, and error handling						
On-line help available	●	●	○	●	●	●
Context-sensitive on-line help	○	●	N/A	●	●	●
Adjustable help levels	○	●	N/A	○	○	○
Documentation						
Keyboard templates	○	○	○	○	●	○
Tutorial	●	●	○	●	●	○
Installation						
Automated installation	●	●	●	●	●	○
Hardware environment recognized automatically	○	○	○	○	○	●
Error messages						
Explains error	○	●	●	●	●	●
Suggests remedy	○	●	○	○	●	○
Tech support						
Cost of single-user paid support	Free	Free	Free	Free	$50	Free
Cost of multiple-user paid support	N/A	N/A	N/A	N/A	$50 per station	N/A

Product name	TechWriter	The Egg	Total Word	PCTeX	T^{e}	Spellbinder Scientific
List price	$395.00	$495.00	$495.00	$499.00	$595.00	$780.00
Price of upgrade	$50.00	$50.00	$99.00	$50.00	$145.00	$295.00
Macros and sort routines						
No. of macros	288	30	Unlimited	Unlimited	Unlimited	15
Includes sort routines	○	○	●	○	○	●
User can elect fields for sorting	N/A	N/A	●	N/A	N/A	●
Help, documentation, and error handling						
On-line help available	●	○	●	○	●	●
Context-sensitive on-line help	●	N/A	●	N/A	●	○
Adjustable help levels	○	N/A	●	N/A	●	○
Documentation						
Keyboard templates	●	○	○	○	●	●
Tutorial	Optional ($50)	●	●	○	●	●
Installation						
Automated installation	●	○	●	●	●	●
Hardware environment recognized automatically	●	●	●	○	○	○
Error messages						
Explains error	●	●	●	●	●	●
Suggests remedy	●	○	●	○	○	○
Tech support						
Cost of single-user paid support	Free	Free	Free	Free	Free	Free
Cost of multiple-user paid support	N/A	Negotiable	N/A	N/A	N/A	N/A

PC—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable: program does not have this feature.

(ends)

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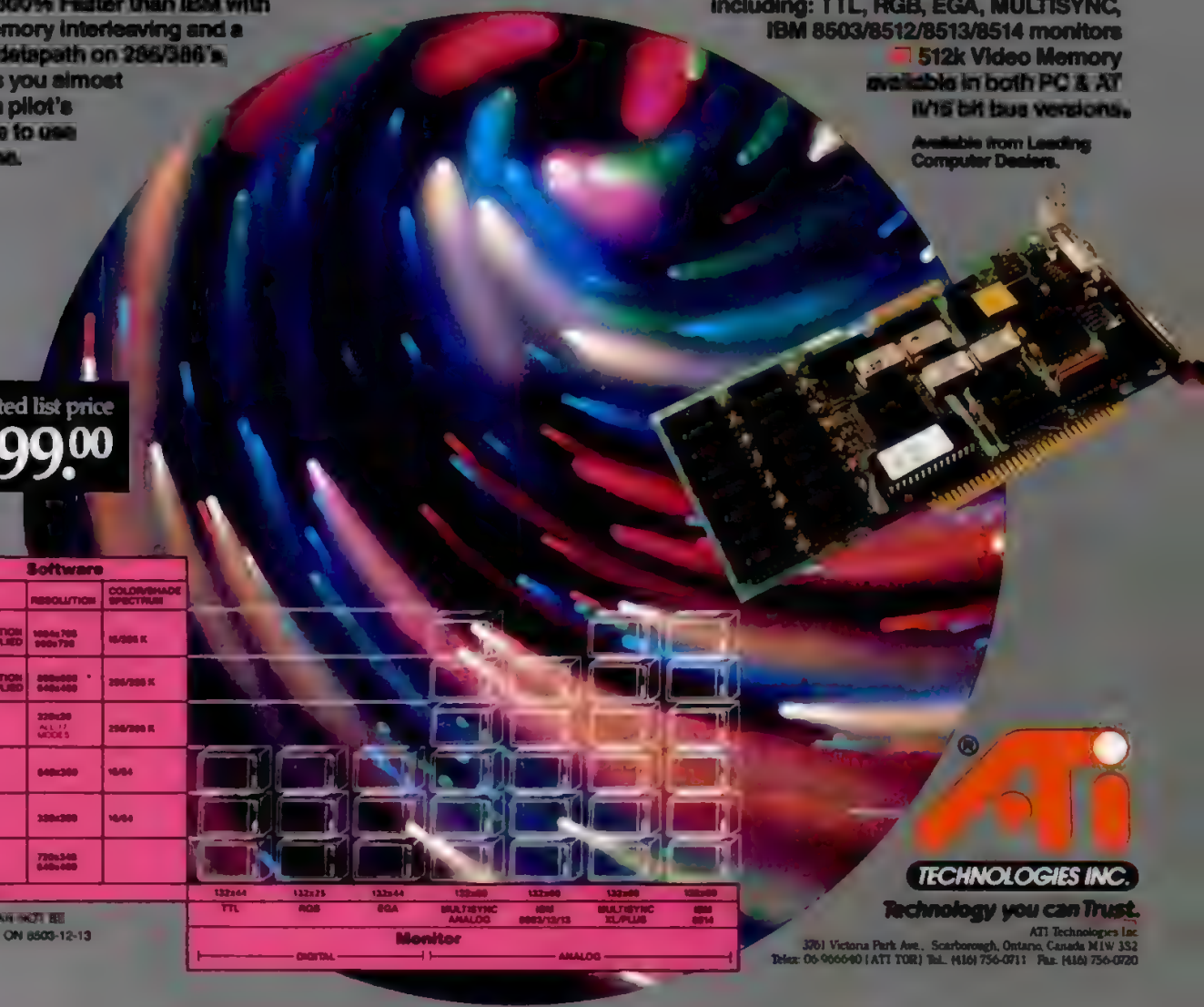

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EGA	640x350	16/64
CGA	320x200	16/64
MDA	720x348 640x400	
LINES OF TEXT	132x44	132x25

Monitor						
TTL	RGB	EGA	MULTISYNC ANALOG	IBM 8503/12/13	MULTISYNC XL/PLUS	IBM 8514
DIGITAL			ANALOG			

* 800 X 600 CAN NOT BE DISPLAYED ON 8503-12-13

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There's even a choice of sizes. The compact ALQ224e is ideal for standard paper sizes and tight spots, while the wide-carriage ALQ324e can handle up to 16-inch-wide spreadsheets.

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So ask your local ALPS dealer for a free ALQe demonstration. And if, for some reason, you find they're not exactly the type of printer you're looking for, call us at 800-828-ALPS. Or, if you're in California, 800-257-7872.

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CIRCLE 242 ON READER SERVICE CARD

The Egg

Perhaps because it can be described as an object with a flawless exterior enclosing material with lots of potential, *The Egg* became The Peregrine Falcon Co.'s code name for its $495 scientific word processor during development. For the most part, that appellation fits: *The Egg* is a fine tool for preparing scientific documents. What is not flawless, however, is the program's nonmath word-processing functions.

The Egg is easy to crack. Installation is a simple matter of copying files from one non-copy-protected disk. (*The Egg* works on floppy- and hard-disk systems.) An hour or so later, after having worked through the tutorial, you are ready to start preparing documents containing equations of varying complexity.

Fonts included with the program contain every important technical symbol (many in several sizes), including some basic chemistry forms. If you need some special symbol not in the fonts, you're free to create it with a utility within the program. (Additional and extensive chemistry fonts are available separately.)

The Egg easily created *PC Magazine*'s sample test equations. Equations, however, cannot be rescaled. Vertical movements are in units of quarter-lines, while horizontal movements can be adjusted to half-character widths. (A future program, *The Egg Bookmaker*, will offer the ability to make small adjustments in any direction and will provide kerning.)

LINES AND LEVELS From *The Egg*'s perspective, an equation or technical expression is held on a single line. This line may have any of 17 levels, and you place your integers, Greek letters, vectors, fraction lines, braces, and brackets on this line at the appropriate level.

Some expressions may extend far above or below the baseline of the line, and *The Egg* does not automatically adjust the interline spacing; you will have to perform this fine-tuning yourself. A special reference symbol on the screen moves up and down to indicate your current position with respect to the true baseline.

The Egg comes with eight fonts, each of which is available in eight sizes, and each size of which is available in normal, bold, italic, and bold italic weights. Just about any scientific character you need can be found in one of the eight basic fonts, and extensive font charts help you to unearth the font containing the one you need.

At any time, two fonts are always online. All of the eight sizes of these two, plus the four weights, are always available as well. It is also easy to bring up other fonts.

But when it comes to reference material, information in *The Egg*'s large, handsomely produced manual is not so easy to educe. The manual is in need of revamping, and some of the phrasing is, in fact, confusing and awkward. One unfortunate omission: you are never told how to start *The Egg!* What you expect to work, fortunately, does—at the DOS prompt, type "egg" followed by a carriage return.

Where the manual fails, the tutorial does its job and brings the new user up to speed in short order. (Peregrine Falcon was working on a new manual, which should now be available.)

PRINTED OUTPUT Not all printers are capable of producing the scientific-technical symbols that are *The Egg*'s specialty. Only about half a dozen printer drivers come with the program, including the IBM Graphics Printer and Toshiba P1351 dot matrix printers, the Diablo 630 daisy wheel printer, and the Hewlett-Packard LaserJet and Apple LaserWriter laser printers.

The Egg can also produce a disk file containing the PostScript instructions for preparing your manuscript. (Otherwise, there is no capability for preparing print files.)

For some users, being able to use a laser printer may not be an issue. In that case, Peregrine Falcon's *Three Minute Egg* will be of interest. In this essentially complete version of the real *Egg*, the ability to print on laser printers and design your own special characters has been removed. This marginally crippled version sells for $225, less than half the price of its hard-boiled relative.

It is a disappointment that more-traditional word-processing tricks were not well integrated into *The Egg*. Efficient cursor movement and sophisticated formatting are not present. *The Egg* performed poorly on the PC Labs benchmark tests primarily because it had difficulty handling the large sample text file. You will do fine if you keep your *Egg* files reasonably short.

With this easy-to-learn WYSIWYG scientific program, you can create virtually any scientific expression you could want. But when it comes to nonscientific word processing tasks, you might find *The Egg* to be a bit runny.—**Alan Hoenig**

PC MAGAZINE FACT FILE

The Egg
The Peregrine Falcon Co.
65 Koch Rd., Suite B
Corte Madera, CA 94965
(800) 621-0851 (ext. 204)
(415) 924-4663
List Price: $495 (copy-protected version, $425).
Requires: 256K RAM, two disk drives, Hercules monochrome or CGA monitor, DOS 2.0 or later.
In Short: *The Egg* is an easy-to-learn WYSIWYG scientific word processor. Virtually any scientific expressions can be created with it, but it is lightweight when it comes to nonscientific word-processing tasks. Not copy protected

CIRCLE 641 ON READER SERVICE CARD

EXP

EXP, from Wadsworth & Brooks/Cole Advanced Books & Software, lets you put scientific or mathematical formulas in your documents and easily edit them later. The screen display is completely graphics oriented, so that what you see really is what you get.

You wouldn't purchase this $150 program as an office word processor, but if you buy it for its technical features you can certainly use it for other tasks. It has all the basic features, including footnotes, headers and footers, columns, multiple windows, even macros.

EXP's display is acceptable on a CGA, but it's most impressive on a higher-resolution adapter like the EGA or Hercules Graphics Card. Naturally you need a

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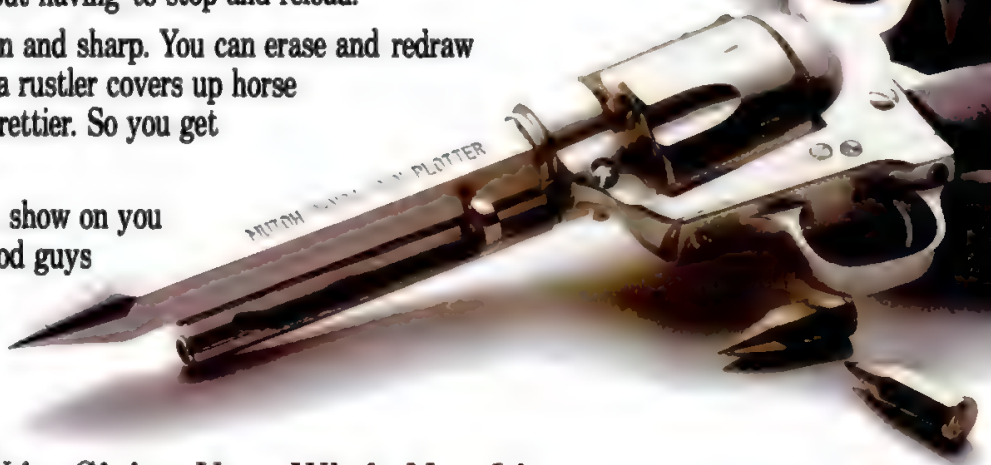

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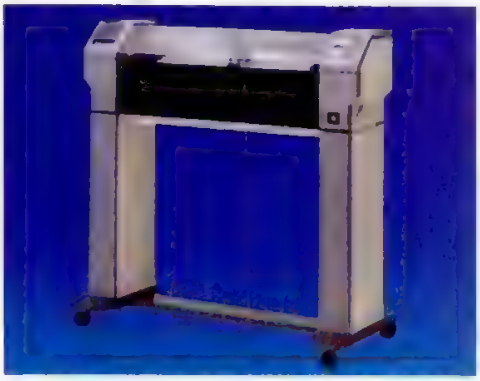

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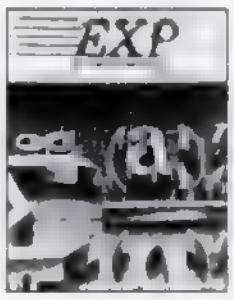

***EXP*, Version 1.11**
Wadsworth & Brooks/
Cole Advanced Books &
Software
511 Forest Lodge Rd.
Pacific Grove, CA
93950-5098
(800) 831-6996
(800) 367-1977 (in Calif. only)
List Price: $150
Requires: 256K RAM, one disk drive (two disk drives recommended for installation), graphics card. DOS 2.0 or later.
In Short: This small, fast program for processing equations and other technical writing is easy to learn and performs well. It displays full WYSIWYG graphics with fonts and symbols in a number of sizes. Not copy protected.

CIRCLE 640 ON READER SERVICE CARD

graphics printer to produce *EXP* documents. At present the software supports five varieties: the Epson MX-80, the Toshiba P-1351, the Epson LQ-1500, the Tandy DMP-2100, and the Hewlett-Packard LaserJet II.

WORKING IN BOXES The basic unit of *EXP* expressions is the *box*. Certain commands—Open, Matrix, Numerator, and others—open boxes; other commands, such as Bracket, Frame, Sqr (the square root symbol), and Close, close the box and may surround it in some way.

Once you have a box, you can connect other boxes to it. The Roof command puts a new box above the current one; Rug puts it below. You get several different choices for subscript and superscript placement, including preceding the box. Best of all, if you insert more text or symbols inside a box, the box grows to fit.

What goes in these boxes? *EXP* offers seven ASCII fonts and six symbol fonts. The latter include almost every scientific and mathematical symbol you could want, along with several Greek fonts and even a Russian alphabet. At present you can't edit the fonts or create new ones, but a mouse-driven font editor will soon be available.

To insert a symbol in the text, you call for it by name. For example, typing "\phi beta kappa" on the command line will put the appropriate Greek letters into the text. You can mix symbols with control codes on the command line, too. The command "\sum1 roof infinity close rug \0\ close" will print a summation from zero to infinity. This command means, "Create a summation character, put an infinity symbol on top of it, and put a zero under it."

If you frequently need that summation from zero to infinity, you might assign it to a keyboard macro. You call *EXP* keyboard macros with a special command key or by shifting to the macro keyboard, so *any* key can be a macro key. *EXP* macros are strictly recorded key sequences without conditional programming, but you can edit them with a utility program.

LIMITED WP FEATURES While *EXP* also boasts many basic features of office word processing, certain features that it might have are absent. A spelling checker, automatic hyphenation, and index generation, to name a few, are not present.

EXP is strictly command driven; there's not a single menu in the program. Also, it doesn't duplicate any DOS functions. If you need a file directory, you press the "DOS shell" key and type DIR. There's no on-line help; if you need to know something, you look it up in the manual or on the Quick Reference card. By leaving out certain amenities and concentrating on the technical features, the authors kept *EXP* small and sleek.

Devotees of Donald Knuth's *TEX* text formatting program will be thrilled to hear that *EXP*-to-*TEX* conversion is in the works. (The program is currently being tested and should appear later this year.) The most common criticism of *TEX* is that it lacks a WYSIWYG interface. *EXP* could give it one.

EXP makes few demands on your system. It will work on a 256K IBM PC with a single floppy disk drive. If you use your computer for many different purposes, or if you need to start working with a technical word processor right away, *EXP* is for you.—**Neil J. Rubenking**

PCTeX

PCTeX, from Personal TeX, is very different from other scientific word processors. For one thing, although it processes documents so they are ready for printing, it is not an editor. You can't write a document with it, move blocks of type around, or do a search-and-replace.

In a sense, *PCTeX* is a language and a compiler. You place *PCTeX* commands into a document prepared with the word processor of your choice, and the program will run the file so that it's ready to be printed. In this programmerlike way you get precise and powerful control over document formats—including typesetting features like ligatures and kerning. The $499 program can also construct almost any mathematical formula or expression.

MAINFRAME ORIGINS Because *PCTeX* (pronounced "PC tech") is a language and has been ported down from the mainframe world, it's not easy to learn or use. It takes dedication and the programmer's sense of detail. This is evident from the very beginning. Installing the program and getting ready to run it can take some time. *PCTeX* comes in pieces: a main program, which actually includes several different sets of *TEX* macros; a document previewer; and a printer driver. Each piece has its own manual, and there is even a separate, over-250-page manual for *LaTex*, one of the macro sets.

The *PCTeX* program itself resides on four disks. Installing this part of the full

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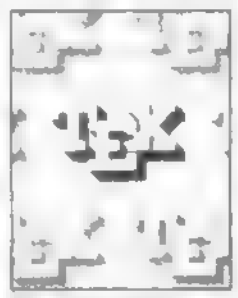


***PCTeX*, Version 2.1**
Personal TeX Inc.
12 Madrona Ave.
Mill Valley, CA 94941
(415) 388-8853
List Price: $499 (including previewer and laser printer driver).
Requires: 512K RAM (640K recommended), hard disk drive, DOS 2.0 or later.
In Short: A typesetting program rather than a word processor, *PCTeX* doesn't let you do interactive editing but affords you total control over formatting, especially of mathematical formulas and equations, once you master its complexities. *PCTeX* delivers superior-quality output and device-independent files. Not copy protected.

CIRCLE 639 ON READER SERVICE CARD

LARGE-DOCUMENT PROCESSING + EQUATIONS − HASSLES = LOTUS MANUSCRIPT

More than just a scientific word processor, this full-featured program's new release offers the best of both worlds.

Finally, a word processor with a powerful equation language that lets you formulate equations as if you were speaking them, instead of drawing them with pixel-based pickup sticks, and that packs enough power to be called a document publishing system. That's *Lotus Manuscript*, Version 2.0.

With a strong set of tools for creating large documents, the original *Manuscript* bridged the gap between traditional word-processing and full-featured desktop publishing. But its full equation language made the $495 package especially appealing to scientists and tipped the balance toward scientific-technical applications.

The difference between *Manuscript*, Version 2.0, which we looked at in its beta release, and the original *Manuscript* is significant: Version 1.0 was a good scientific word processor; Version 2.0 competes feature for feature with the major corporate word processors. Version 1.0 hung together beautifully; at first glance, Version 2.0 borders on awesome.

Although you gain a lot with the new release of *Manuscript*, you don't give up anything in ease of formatting equations. You type f(x sub1) Delta x = 0, and *Manuscript* responds with a sculpted

$$f(x_1)\Delta x = 0$$

As you create an equation, you can size it, scale it, justify it, include it in a table of tables, and preview it on a full display screen. The equation becomes, in effect, a concise statement combining both format and content information. An equation editor makes reworking equations a snap.

Equation-handling prowess is only a minor part of *Manuscript*'s many abilities.

Manuscript's skillful handling of tables of contents, indexes, references, and notes materials makes it a good choice for all types of report writing. Optimized for the sci-tech crowd, the program's document-handling tools are equally suited for the creation of any highly structured document.

WHISTLE WHILE YOU FORMAT

At the heart of *Manuscript* is a unique way of approaching document creation. Whether it's a cross-reference, a chart, a column of text or data, a table of contents, a footnote, an equation, a section heading, or a paragraph of text, *Manuscript* lets you format at the same time you compose. All documents are made of building blocks: text, blocks (which are units of text with similar attributes), columns (which are vertical blocks), and sections. Each of these units can be created with a single keystroke and subsequently edited and formatted.

A well-integrated outliner is the backbone of the system. You create a detailed outline by promoting and demoting and collapsing and expanding. Taking the concept further, you can format the various levels of your outline. A series of format panels prompts you to make numerous decisions about the appearance of the printed page.

Much of *Manuscript*'s grunt work is a one-time-only affair. Laser printers and downloadable fonts are controlled via a Global Typeface Setup panel. You create a table of up to 20 fonts for point-and-place insertion in a document. I tested the beta version of *Manuscript*'s custom version of Bitstream fonts, the *Fontware Installation Kit for Lotus Manuscript* ($95 from Bitstream), and found creating and editing custom fonts to be a well-integrated and easy-to-handle process.

QUILTING LARGE DOCUMENTS

Large documents typically don't live by text alone; they are a patchwork of all sorts of nontext material—and *Manuscript* can handle just about all of them. There's a built-in table maker that creates multiple columns as you specify column and gutter widths. A border layout tool lets you create a mock-up of how you want a block (or blocks) of text bordered. Together, the table maker and borders are infinitely superior to any combination of drawing tools and tabs I've ever had the misfortune to work with.

Graphics created using *Freelance Plus*, *Graphwriter*, *Lotus 1-2-3*, *Symphony*, as well as other packages can be inserted, scaled to size, and placed on the page by answering questions on a single pop-up panel. Scanned images from a variety of popular scanners can be insert-

FACT FILE

***Lotus Manuscript*, Version 2.0**
Lotus Development Corp.
55 Cambridge Pkwy
Cambridge, MA
02142
(800) 345-1043
(617) 577-8500

List Price: $495; upgrade from Version 1.0, $75.

Requires: 512K RAM (640K recommended), hard disk drive, graphics display card for print preview, DOS 2.0 or later.

In Short: This powerful document processor sports a table editor, equation formatting, hot links to spreadsheets, an integrated outliner and spelling checker, and a host of other valuable features. It tackles the job of creating large documents and simplifies the process of entering equations. Not copy protected.

CIRCLE 631 ON READER SERVICE CARD.

ed with a single command, and *Manuscript* can accept PostScript files.

You'll be impressed with the live spreadsheet link into documents. You can first create a formatted document to house *1-2-3* data and then insert the worksheet (or range) on command.

A pop-up Marker menu rounds out the package's overwhelming supply of commands. Markers are *Manuscript*'s way of indicating places in the document where extraneous material belongs. There are markers for just about anything that isn't text. Orientation markers signal a change from landscape to portrait. Author, date, revision, and file-time markers insert those pieces of information into the document. A screen marker inserts a captured screen image (sized and scaled) into place. Markers even handle *Manuscript*'s conditional mail-merge.

At every turn *Manuscript* meets you with a feature. Two on-screen windows let you edit multiple documents. A series of page-layout panels customizes title pages, index pages, and others. You can create an elaborate series of special characters, such as daggers and bullets, using specified keystroke sequences.

SEPARATE BUT EQUAL Most newer word processors tout the fact that they offer WYSIWYG representation. *Manuscript* is not a WYSIWYG word processor. But, it's designed in much the same way that many earlier word-processing programs were: with a text editor and a print formatter/previewer.

During text editing the display is used in text mode. To see a page layout, you use a graphics display monitor and *Manuscript*'s Print Preview.

Because *Manuscript* is not busy redrawing bit-mapped graphics screens each time you make a move, and because all of the extraneous document pieces are merely marked for inclusion at print time, the text-editing process is fast, even when you're working with large documents. You can preview the printed document to the screen and see a true page display, including graphics, equations, and fonts. You can get an overview of the layout with "greeking" or zero in on text, using *Manuscript*'s magnification window. You can even create full-screen previews of a single graphic or equation without previewing the entire document.

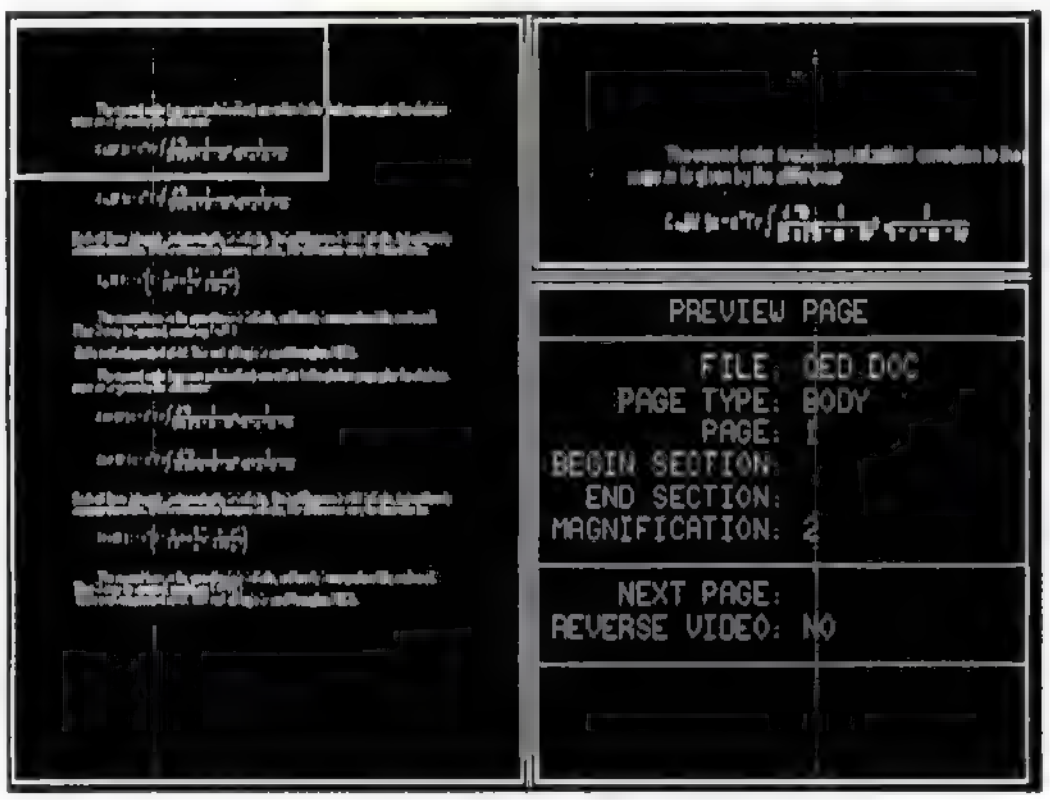
TOO TOUGH TO HANDLE? All powerful word processors have steep learning curves, but many users feel that *Manuscript*'s is the Mount Everest of learning curves. Actually, the initial philosophical hurdle of thinking in "blocks" is tough. Once you make the leap, the rest is perfectly sensible.

Sometimes *Manuscript*'s keystroke requirements save you time, but often you find yourself pressing more than your fair share of keys. Most edit command functions are assigned to the function and Alt-function key combinations. But since many of the keys can perform an action on a block, column, or section of text, you'll always need to specify the amount of text as well as the action.

Some of the more-common keystroke assignments are bizarre. For example, the Ins key is used to execute commands rather than to toggle between overstrike and insert modes. The Spacebar is the potpourri keystroke; when in doubt, hit it. It brings up the available submenus, toggles between yes and no prompts, and checks items on pop-up option lists, to name a few of its capabilities.

Is *Manuscript* simply too big and cumbersome to use for cranking out a simple letter? It depends on content. There are tools to track the author, comments, and revision numbers of a document much like those of any other corporate word processor. But if you're just typing ordinary text, you probably don't want *Manuscript*. On the other hand, if your letters include logos, signatures, tables, and a few boilerplate paragraphs, you might be pleased with *Manuscript*.

Products evolve strangely. Lotus Development Corp., a company known for corporate applications, has created a sui generis scientific-technical word processor. On closer inspection, the sci-tech crowd has an enviable product. *Manuscript*, Version 2.0, is bigger than the sci-tech market.—**Robin Raskin**



Lotus Manuscript's Preview Page function gives you a "greeked" look at a page before printing. A page is shown to the left, with its upper portion blocked off for 2X magnification (up to 10X is permitted). Below: An equation can also be magnified, ungreeked, by using the Graphics Zoom function. This image can fill the entire screen.

$$C_{\mu\nu}(M) = -e^2 Tr \int \frac{d^4k}{(2\pi)^4} \frac{1}{k-m+i\epsilon} \gamma^\mu \frac{1}{k-q-m-i\epsilon}$$

package is as simple as typing "install." While this transfers all the program files onto your hard disk, that's not the end. You need to create special format files. The manual guides you through two such procedures. Each takes only two commands and several minutes to accomplish, but it involves reading through 20 pages of documentation and can be confusing.

Next comes the *PCTeX* menu configuration. *PCTeX* can be run by typing commands at the DOS prompt, but Personal TeX has added a menu to make the program a bit more friendly. The menu has seven commands: Edit, Compose, View, Print, Typeset, MSDOS, and Quit. To configure the menu so that it carries out its functions properly, you have to copy the PCTEX.CFG file to your word processor or use the DOS editor EDLIN to change it. These changes can be fairly simple, or quite complex if you add options such as modified error handling or memory management. Finally, you install the preview program, which might necessitate changing the .BAT file and the printer driver, each supplied on one disk, and the Computer Modern fonts, which come on five or more disks (depending on your printer). When you finish, you will have one main directory, six second-level directories, and seven third-level directories; in the process, you will have used up 4 to 6MB of space on your hard disk.

A THICKET OF COMMANDS Your first and predominant usage of *PCTeX* happens outside its boundaries, in your word processing package. Because *PCTeX* is a typesetting program, you have to embed formatting and typesetting commands in your word processing documents. This involves using a bewildering thicket of curly braces, slashes, percent signs, superscript symbols, command words, and letters. For example, if you wanted to italicize the words "italic correction" in a sentence, you would type: {\it italic correction\/}; if you wanted to underline those words as well, you would type: \underbar{\it italic correction\/}.

Mathematical expressions are even more complex to type. The simple equation, 1+2=3, would be entered as $$1+2=3$$, which is straightforward. But a more complex formula like *x* divided by 1 plus *x* over 2 would be written as: $$\frac x{1+\dfrac x2}$$. And a formula involving large parentheses, with the square roots of several variables added together, then raised to the second power, would read: $$\left(\sqrt{\frac ab+(x+y)^2}+1 \right)^2.

Unfortunately, some of the basic formatting techniques, such as setting and changing margins or creating a table, aren't even in the *PCTeX* manual. To find them you would have to consult a textbook called *The TEXbook*, by Donald Knuth (Addison-Wesley Publishing Co.)

As it turns out, document margins are entered at the top of a file. The default setting is for 1-inch margins all around. If you wanted a top margin of 1½ inches and a 1½-inch margin on each side, you would type: \voffset=1.5in \hoff\hoffset=1.5in \hsize=5.5in. Then, if you wanted to set off a paragraph by narrowing its width (that is, increasing its margins by half an inch), you would type \leftskip=.5in \rightskip=.5in at the beginning of the paragraph. To create a table, you have to use the "\halign" command, the pound sign, ampersands, and the \cr command in an eye-straining array.

■ *PCTeX* offers ample rewards; you can achieve incredible precision in formatting text.

VERSIONS AND VARIATIONS Obviously, formatting takes time and slows down document creation. There are approximately 900 command symbols, letters, and words in the *PCTeX* vocabulary. As if this weren't daunting enough, *PCTeX* comes in several varieties: plain, *LaTex*, and *AMS-Tex*. Each of these versions of *TEX* expresses commands in a different way and adds more of them. There are also style files to learn—smaller sets of *TEX* macros designed for specific tasks. The ltr style, for example, allows you to typeset business letters.

After a document has been written and edited, the *PCTeX* program takes over. First you have to "compose" the document. In essence, this step compiles the file from the language commands. It uses a batch-processing approach, so you have to wait for the whole document to be composed before you can view or print pages. The composed file is given a .DVI extension, which stands for "device independent."

By now it must be clear that this program is not for everyone. But despite its complexity and the time you will need to invest in learning it, *PCTeX* offers ample rewards. You can achieve incredible precision in formatting text, especially mathematical expressions.

Symbols in a formula can have superscripts stacked as high as you like; in fact, superscripts, subscripts, fractions, and binomial coefficients can all be nested in any order of complexity. You can generate large operators, such as a summation symbol or the integral sign, surrounded by limit symbols in different type styles. The program will also align formulas, produce matrixes, thin the space between expressions in a formula, and more.

Since *PCTeX* is a typesetting program, it automatically takes care of *kerning* (adjusting the space between letters) and will even insert *ligatures* (certain pairs of letters bound together tightly for optimal appearance. The many typesetting features and the precision formatting make for printed documents of typeset quality. I've never seen better-looking documents from a dot matrix printer—they look like professionally produced manuscripts or books.

PORTABILITY OF FILES Another important reward is the portability of the composed document files. The .DVI files can be used with mainframe, minicomputer, and PC systems. They can be printed by dot matrix and laser printers or by typesetting machines—without any significant difference in the final output.

Since *TEX* is a public-domain program, there are a lot of people developing add-ons and extensions. In fact, there are several other PC versions of *TEX*. One of these is Addison-Wesley's *MicroTEX*. Two other versions, *TurboTex* and *CommonTex*, are shareware products. There is

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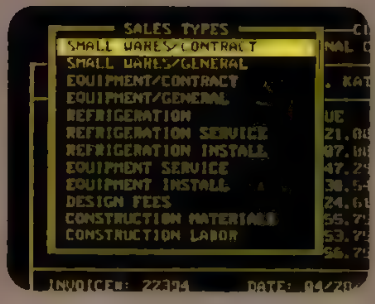

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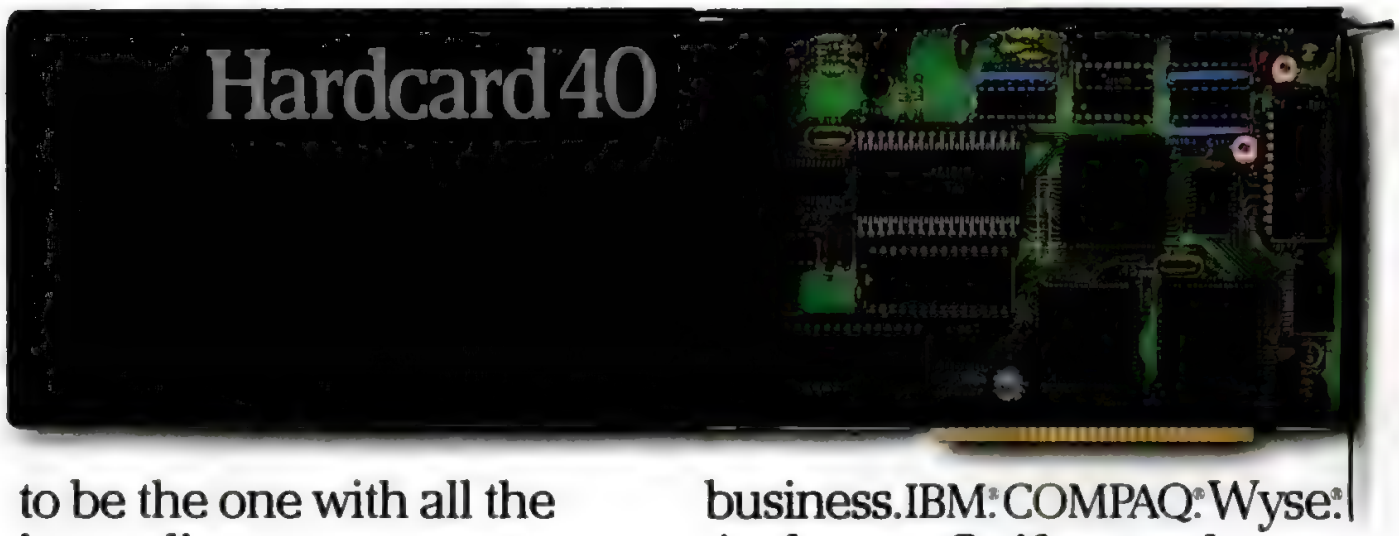
people have immediate questions, you won't have to be the one with all the immediate answers.



More importantly, Plus Hardcard is the most reliable (40,000 hours MTBF) fixed disk available. It also happens to be extremely fast (access time 35ms) and durable (100 Gs). And it's compatible with some of the biggest names in the business. IBM.® COMPAQ.® Wyse.® And more. So if upgrade interruptions have kept you from getting to bigger issues, call us for complete compatibility and other technical information at 1-800-826-8022.

Plus

Machines Corporation; COMPAQ/Compaq Computer Corporation; Wyse/Wyse Technology. © 1988 Plus Development Corp.

CIRCLE 164 ON READER SERVICE CARD

also a *TEX* Users Group in Providence, Rhode Island.

Not your run-of-the-mill PC-based document processor, *PCTeX* is extremely powerful but proportionally hard to use. If you are a scientist or an academician who wants total control over the typesetting of a manuscript, then this is the program for you.—**Henry Fersko-Weiss**

PS

PS, from Scroll Systems, is a powerful scientific and technical writing tool. Originally written for the Victor 9000 before IBM introduced the PC, the $395 program is actually a hybrid of Phoenix Computer Products' *Pmate* text editor and Scroll Systems' text-formatting and presentation facilities. Its impressive range of capabilities includes all the basic text-editing features you'll want, plus extensive macro, programming, and print-formatting features.

PS's ability to simplify the input and presentation of complex equations sets it apart from many other packages. Its Greek/math symbol set includes integrals, sums, plus/minus signs, and braces. The symbols are called up by using Alt- and Shift-key combinations. They can be edited, and they can all be represented on the screen in both text and graphics preview modes. You can also create your own font—important for those who use unusual notation in their documents.

In addition, *PS* offers you a choice of keyboard configurations. Combining the Ctrl, Alt, and D, F, G, or Q keys will change your keyboard to Dvorak, French Azerty, German or back to Qwerty.

While you're learning the ins and outs of symbol placement, you can call up a representation of the keyboard you're using, which pops up across the bottom of the screen. Unfortunately, it disappears when you strike the next key. Becoming familiar with the various keyboards would be a lot easier if the program would display the keyboard diagram in a window until it's no longer needed.

FULL RANGE OF PRINTERS *PS* supports the full range of printer types: daisy wheel, dot matrix, laser, and graphics. Naturally, which print capabilities you get depend on the type of printer you use. On most dot matrix printers, *PS* supports the standard high- and low-order ASCII character sets, which is enough for most applications. Greek/math, italic, and script characters are supported on the Toshiba printers, the C. Itoh Prowriter 8510, and the NEC 8023.

But *PS*'s most impressive print capabilities are realized with the Hewlett-Packard LaserJet and the Imprint Technologies LightWriter. The LightWriter is available as a special package from Scroll Systems and includes a special interface card that must be installed in your PC.

Equations are entered in linear format in *PS*'s text mode, using the actual Greek and mathematical symbols. The convention is fairly easy to learn and is easily readable in text form once you get accustomed to it.

Subscripts and superscripts, important in most technical documents, are set up manually by embedding control characters in the text. There's no limit to the number of levels of super- and subscripting, but you have to plan for the correct placement on the page to avoid overprinting. Placement of super- and subscripted expressions in equation mode is automatic.

Tables, also very important, are handled rather poorly; the program has only a rudimentary table-building facility. Nor can it perform block operations on columns of text. *PS* does, however, have a basic ability to plot graphs and include them in the text.

AUTOMATIC FOOTNOTING *PS* does a better job when it comes to footnotes. An automatic footnoting feature allows the program to identify footnotes as they are typed into the text and to stack them at the bottom of the page. As footnotes are stacked, the amount of space needed is measured, and the bottom margin of the page is moved up accordingly. *PS* comes with a separate macro that can be used to scan a completed document and number the footnotes.

Other macros that come with *PS* include an automatic indexer, a mail-merge/addressing facility, and a phone dialer. You can write complex programs and assign up to about 350 macros using PS's programming language.

Mastering this language is the key to getting the most out of the package. It's also a major limitation. Nonprogrammers will have some trouble with *PS*. It's really aimed at experienced programmers who are willing to do some work.

This bias is reflected in the documentation. The manual is erratic, abruptly swinging from language appropriate for a novice to a very technical programming style. It assumes that the reader can puzzle out unsupported references, and it fails to explain some commands.

Although installation is easy, novice users won't be able to figure out what to do. The instructions are scattered among two appendixes, one extremely technical, and a READ.ME file on the program disk.

The major installation requirement is setting up an AUTOEXEC.BAT or another activating batch file. And you do have to be careful in dealing with SYMBOL.COM, the program that reconfigures the keyboard. You have to make sure that if you quit *PS* and then return to it without rebooting the system, your batch file won't try to reinstall SYMBOL.COM over itself. That fatally hangs up the system.

SYMBOL.COM, unfortunately, makes *PS* largely incompatible with most TSR programs, such as *SideKick*. The program plugs in its own values in the keyboard queue, changing the Alt-key combinations used by TSRs.

Another problem is *PS*'s awkward feel. Its numerous command types require some unusual key combinations. And commands are grouped poorly, making them

FACT FILE

***PS*, Version 1.4**
Scroll Systems Inc.
5530 N. Camino Escuela
Tucson, AZ 85718
(602) 299-8087
List Price: $395
Requires: 256K RAM (512K recommended), two disk drives, DOS 2.0 or later.
In Short: This scientific-technical word processor excels in making complex formulas easy to enter. Both the manual and the software are geared toward advanced users with programming experience. Not copy protected.

CIRCLE 638 ON READER SERVICE CARD

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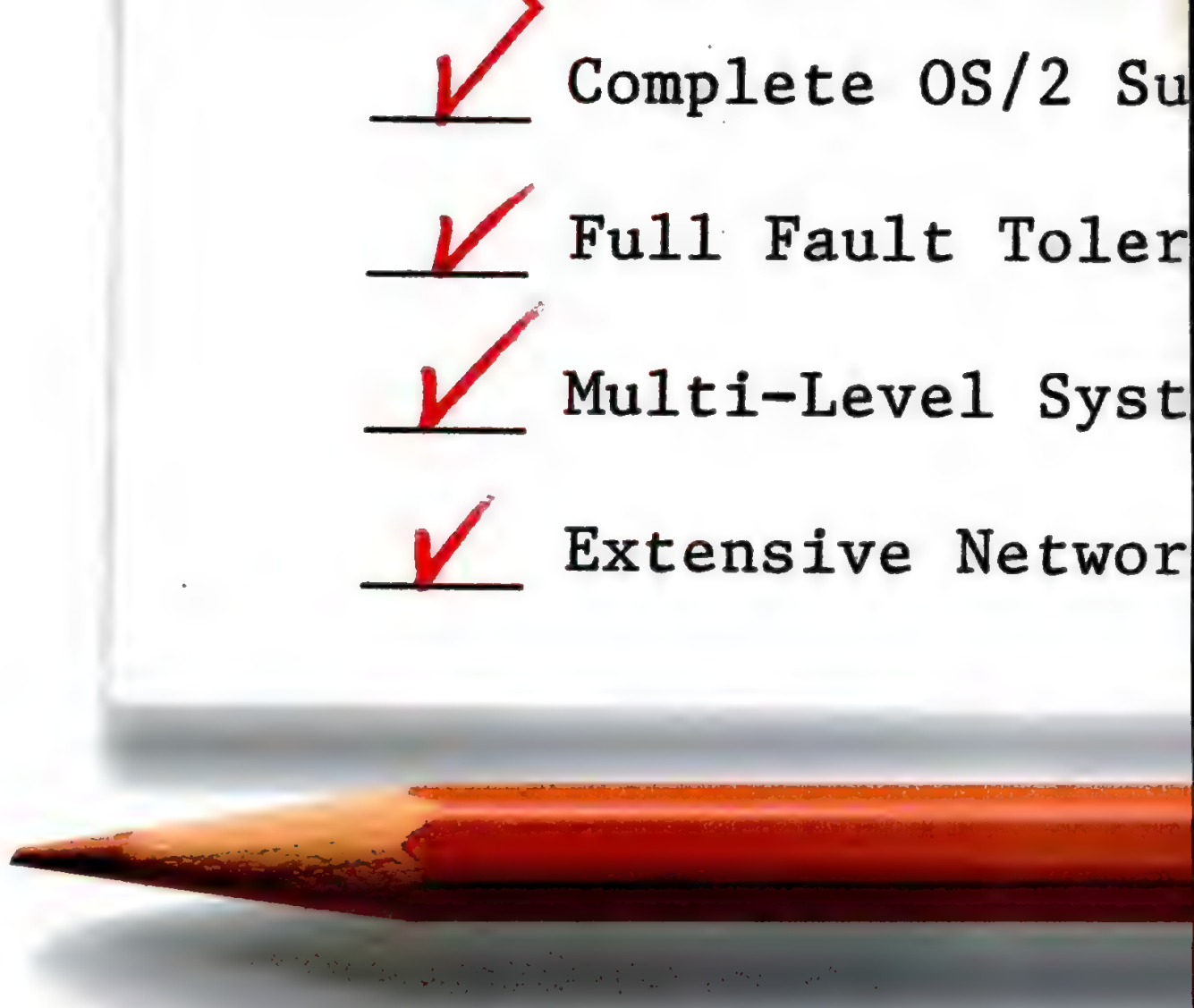

SFT NetWare® v2.1 MIS-conceptions about

Traditionally, the MIS world has viewed PC-based local area networks with a healthy dose of skepticism. A "prove it to me" attitude. And in an arena ruled by powerful mainframes, that approach has given rise to a few misconceptions and doubts about LAN performance.

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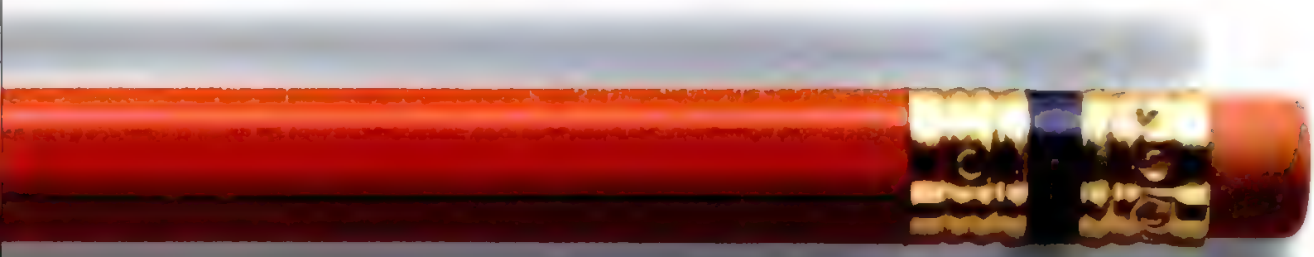

puts to rest the LAN performance.

SFT NetWare v2.1 simplifies network management with menu-driven utilities that let you control the network from any workstation. Advanced accounting features allow you to audit and account for users or departments utilizing network resources. Available communications links give you unsurpassed connectivity with mini/mainframe systems and other LANs. And SFT NetWare v2.1 supports OS/2 as well as DOS workstations.

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CIRCLE 103 ON READER SERVICE CARD

Performance Tests: Scientific Word Processors

We chose *WordPerfect* as the standard against which to measure all of the word processors reviewed in *PC Magazine*—corporate, professional, personal, and scientific/technical—not because of its performance, but because of its popularity and widespread use. It was one of the top five performers in *PC Magazine*'s roundup of word processors in the February 29, 1988, issue and turned in similar results this time around.

Since *Alexander* and *PCTeX* (unlike all of the other packages) were unable to import the 50K test document, no results are reported for these two packages. *Alexander* more closely resembles the other packages in this category but was able to import only about 70 percent of the test document. Unlike the others, *PCTeX* works with an existing word processor and uses typesetting rather than traditional document-control commands. In addition, one-third of the packages—*The Egg*, *ChiWriter*, *WordMarc Composer*, and *PS*—could not complete two or more of the tests.

With the exception of the Print Whole Document test, which it did not pass, *EXP* was a solid performer across the board. It consistently placed among the top five packages.

Three packages passed all the tests without a hitch: *T³*, *TechWriter*, and *Total Word*. Of this group, *T³* produced some of the slowest results, coming in last or close to last in five of the tests. However, the package showed its speed in the Global Search and Replace test, capturing first place. Despite its slowness in performing many document-handling tasks, *T³* is still a good choice because of its powerful font editor; scientific, mathematical, and chemical fonts; and Greek and Russian alphabets.

Although *Spellbinder Scientific* placed among the top five packages in the Save and Resume and Text Delete tests, it could not perform seven of the other tests and was the slowest in the Print Whole Document test. Despite these less-than-impressive results, *Spellbinder* is still worth considering because of its scientific-text-processing capabilities.

The PC Labs word processing tests were performed on an 8-MHz IBM PC AT outfitted with a 30MB hard disk drive, an Intel Above Board (supporting 2MB RAM), and an EGA card. Additionally, a 1MB RAMdisk was created to perform the Print Whole Document test. All programs were run under DOS 3.2 with files and buffers equal to 20.

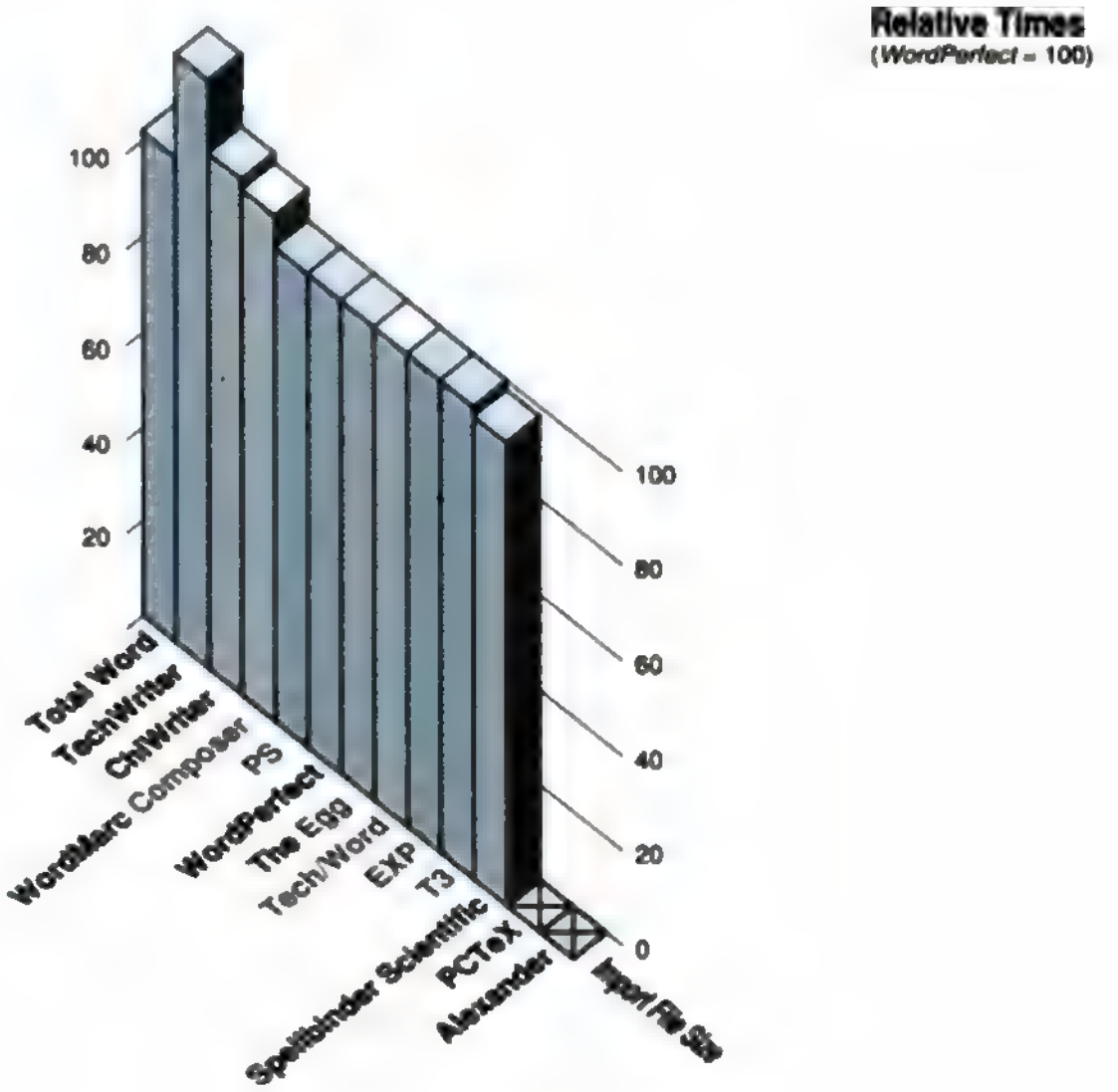
The tests were done using a 50K document file—approximately 14 pages long and without page numbering. The document contained 8,835, words, with 66 lines per page and 72 characters per line. The reported speeds measure the time from when the last keystroke was entered to the moment when control of the keyboard, still in editing mode, was returned to the tester. For each test except one, the original test document was used as the source document. Reported performance times are the average of three test trials, measured in seconds.

IMPORT FILE SIZE

The **Import File Size** test measures in bytes the final imported file size once a program brings a 50K document into its own environment. Programs manipulate files differently—for example, in the way they insert formatting codes into the document—hence the imported file size varies. Software that could not import the 50K file could not be tested. However, the inability to import large files should in no way reflect on a program's performance with smaller documents.

Performance	Import File Size (bytes)
Total Word	51,072
TechWriter	61,952
ChiWriter	54,300
WordMarc Composer	53,248
PS	50,000
WordPerfect	50,000
The Egg	50,012
Tech Word	50,000
EXP	50,000
T³	50,000
Spellbinder Scientific	49,000
PCTeX	N/A
Alexander	N/A

N/A—Not applicable: function not available.

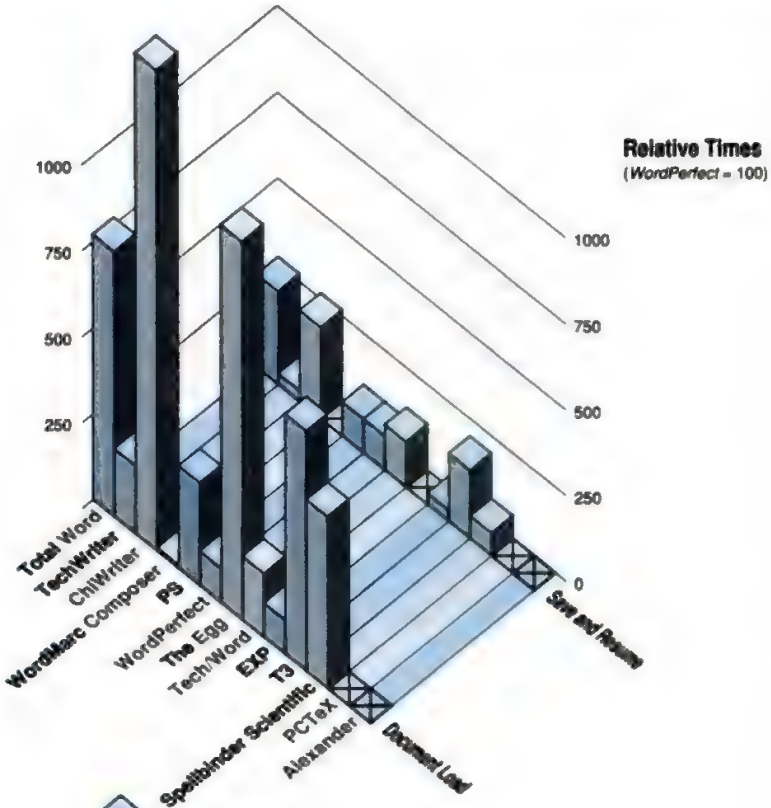


DOCUMENT MANIPULATION

The **Document Manipulation** tests measure the time it takes a word processor to load and save a file. **Document Load** measures the time it takes to call up the file imported in the Import File Size test. **Save and Resume** measures the time it takes a program to save the same document and return control of the keyboard to the tester.

Performance Times (Times given in seconds)	Document Manipulation	
	Document Load	Save and Resume
Total Word	7.73	8.16
TechWriter	2.00	1.00
ChiWriter	14.00	8.00
WordMarc Composer	0.10	N/A
PS	3.00	3.00
WordPerfect	1.00	3.00
The Egg	11.00	4.00
Tech/Word	1.85	N/A
EXP	1.00	1.00
T³	7.00	6.00
Spellbinder Scientific	5.00	2.00
PCTeX	N/A	N/A
Alexander	N/A	N/A

N/A—Not applicable, function not available

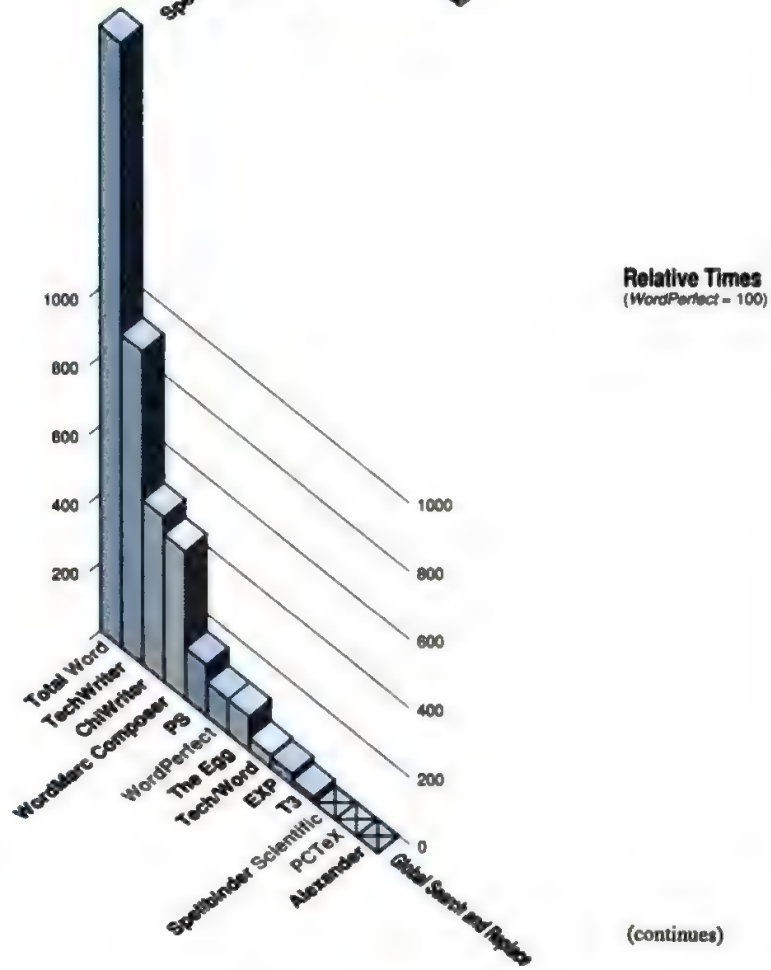


GLOBAL SEARCH AND REPLACE

The **Global Search and Replace** test measures how long it takes a word processor to replace 115 cases of the word *his* with the word *theirs*. Sensitivity to upper- and lowercase letters was noted in the reporting of each result.

Performance Times (Times given in seconds)	Global Search and Replace
Total Word	105.91
TechWriter	55.00
ChiWriter	29.00
WordMarc Composer	26.00
PS	9.00
WordPerfect	6.00
The Egg	6.00
Tech/Word	2.34
EXP	2.00
T³	1.02
Spellbinder Scientific	N/A
PCTeX	N/A
Alexander	N/A

N/A—Not applicable, function not available.



(continues)

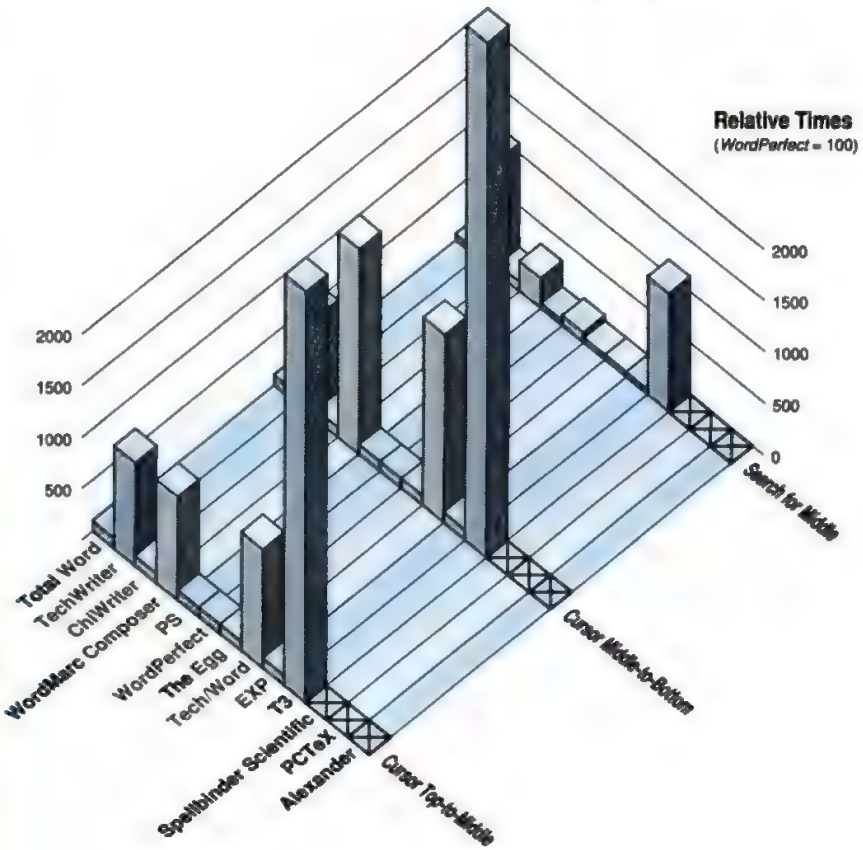
Performance Tests: Scientific Word Processors

CURSOR MOVEMENT

The **Cursor Movement** tests determine how long it takes to move the cursor through a document. The **Cursor Top-to-Middle** test times the jump from the top, or Home position, to a predefined point in the middle of the document. The **Cursor Middle-to-Bottom** test times the jump from the midpoint to the bottom, or End position, of the document. The **Search for Middle** test measures the time it takes to find a sentence placed in the exact middle of the document. Since some word processors cannot search for an entire sentence, the test allows for searching on a keyword or string of words.

Performance Times (Times given in seconds)	Cursor Movement		
	Cursor Top-to-Middle	Cursor Middle-to-Bottom	Search for Middle
Total Word	0.10	0.10	1.30
TechWriter	1.00	1.00	22.00
ChiWriter	0.10	0.10	2.00
WordMarc Composer	1.00	2.00	6.00
PS	0.10	0.10	1.00
WordPerfect	0.10	0.10	2.00
The Egg	0.10	0.10	1.00
Tech/Word	1.16	1.83	1.01
EXP	0.10	0.10	1.00
T³	4.00	5.00	23.00
Spellbinder Scientific	N/A	N/A	N/A
PCTeX	N/A	N/A	N/A
Alexander	N/A	N/A	N/A

N/A—Not applicable: function not available

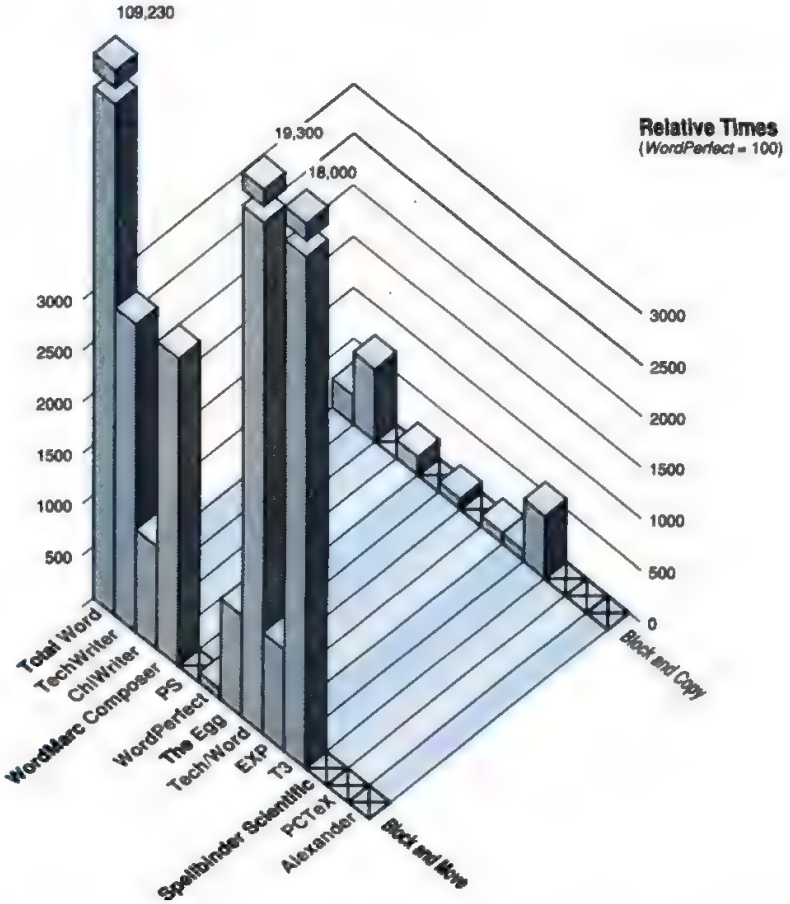


BLOCK MANIPULATION

The **Block Manipulation** test is based on two separate timings. The **Block and Move** test records the software's ability to define, or highlight, the first three pages of the test document and then move it to the center of the document—somewhat like a cut-and-paste operation. This test moves but does not delete the text. The **Block and Copy** test takes the same three-page block and copies it to an external file. Both tests require large-scale page reformatting that slows the performance of some programs, depending on how well they handle the task in a RAM buffer. The larger the buffer, the faster the results.

Performance Times (Times given in seconds)	Block Manipulation	
	Block and Move	Block and Copy
Total Word	109.23	2.77
TechWriter	3.00	7.00
ChiWriter	1.00	N/A
WordMarc Composer	3.00	1.85
PS	N/A	N/A
WordPerfect	0.10	1.00
The Egg	1.00	N/A
Tech/Word	19.30	1.05
EXP	1.00	1.00
T³	18.00	6.00
Spellbinder Scientific	N/A	N/A
PCTeX	N/A	N/A
Alexander	N/A	N/A

N/A—Not applicable: function not available.



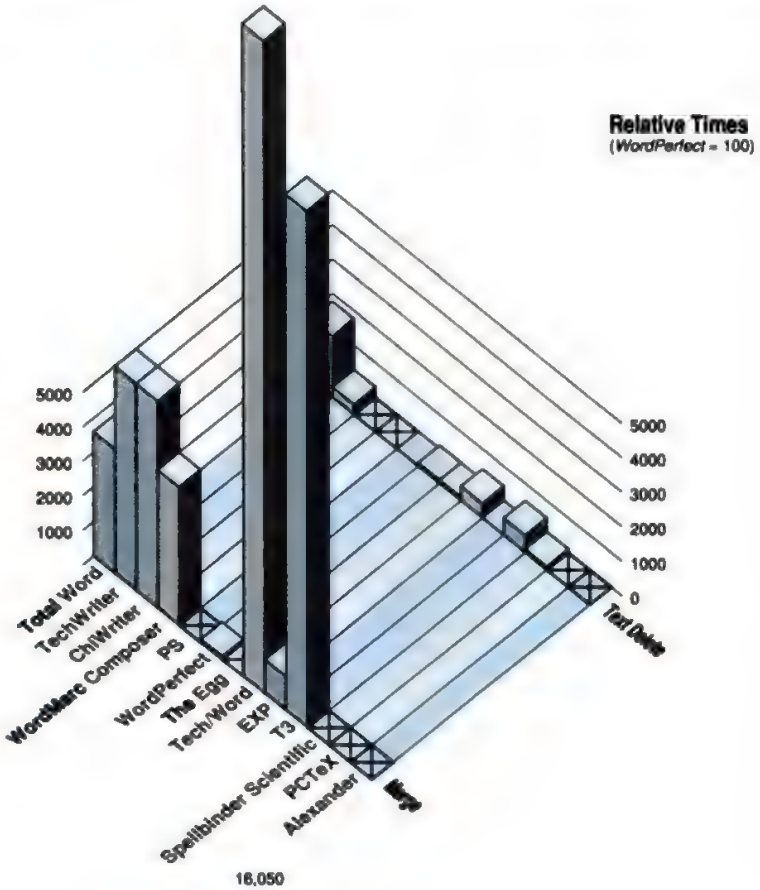
MERGE AND TEXT DELETE

The **Merge** test times the program's ability to import an external file to a point immediately following the middle of the document file. The external file consists of the first three pages of the original document. Again, page formatting affects the performance results.

The **Text Delete** test times how long it takes to define and delete the file that the Merge test imported and inserted into the document. Again, this procedure requires significant page reformatting, and the program's buffering capability greatly affects performance.

Performance Times (Times given in seconds)	Merge	Text Delete
Total Word	3.61	17.66
TechWriter	6.00	3.00
ChiWriter	6.00	N/A
WordMarc Composer	4.00	N/A
PS	N/A	0.10
WordPerfect	0.10	1.00
The Egg	N/A	1.00
Tech Word	18.93	4.21
EXP	1.00	0.10
T³	15.00	5.00
Spellbinder Scientific	N/A	1.00
PCTeX	N/A	N/A
Alexander	N/A	N/A

N/A—Not applicable; function not available

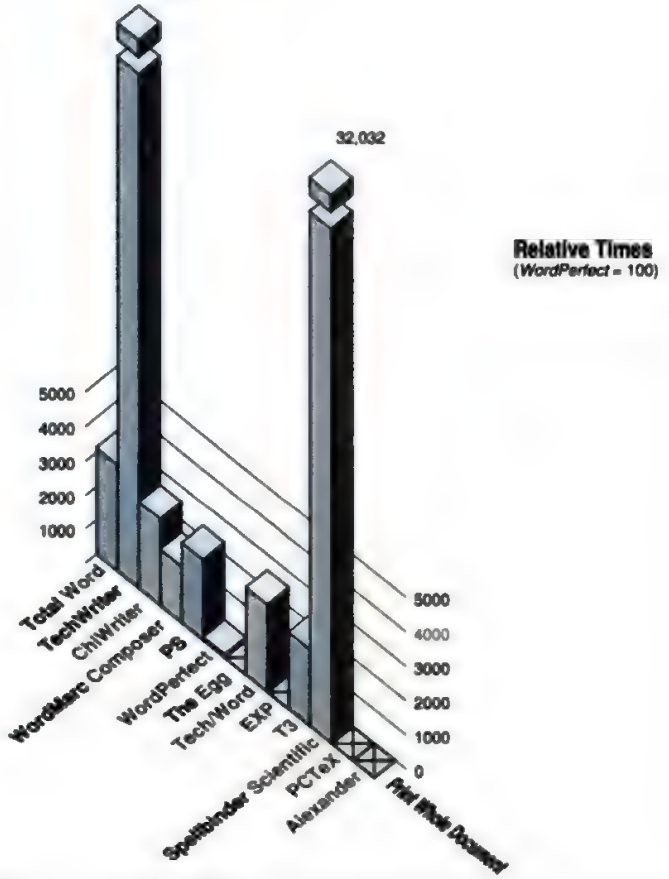


PRINT WHOLE DOCUMENT

The **Print Whole Document** test uses a 1MB RAMdisk and times the program's ability to print the entire 50K test document to an external file.

Performance Times (Times given in seconds)	Print Whole Document
Total Word	52.89
TechWriter	321.00
ChiWriter	51.00
WordMarc Composer	33.00
PS	47.00
WordPerfect	2.00
The Egg	N/A
Tech Word	50.89
EXP	N/A
T³	45.00
Spellbinder Scientific	640.64
PCTeX	N/A
Alexander	N/A

N/A—Not applicable; function not available



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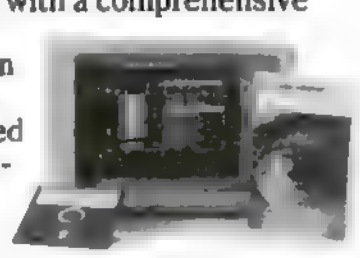

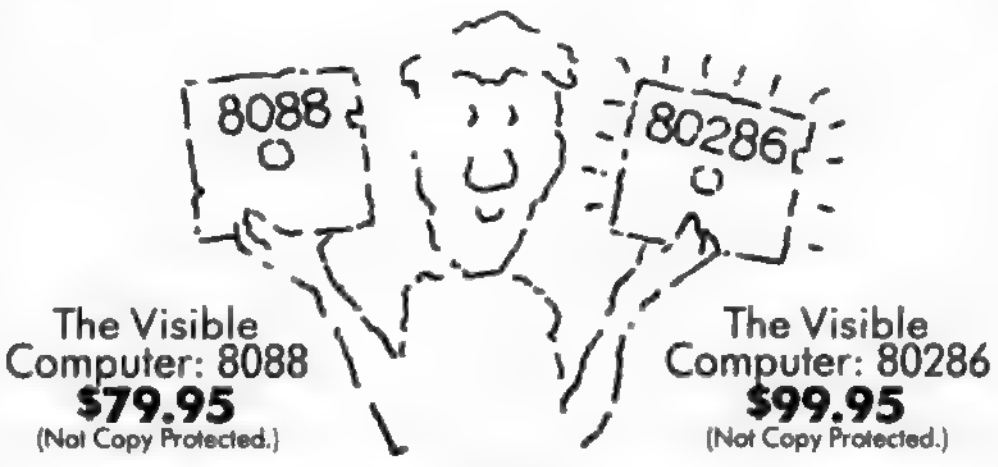

The Visible Computer: 8088
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CIRCLE 487 ON READER SERVICE CARD

rather hard to memorize.

Overall, *PS* is difficult to master. Nonetheless, it offers exceptional facilities that will make life a lot easier for experienced programmers who need to enter and format technical or scientific text and equations.—**Walt Rowinski**

Spellbinder Scientific

Spellbinder Scientific, Spellbinder Software Products' $790 adaptation of its *Spellbinder* word processor, does an impressive job of handling scientific text. Both *Spellbinder* versions share the same command sequences, function keys, edit-mode features, and command-mode features. Features unique to the scientific version are implemented with function keys and macros.

Spellbinder Scientific lets you freely intersperse and display formulas, equations, and diagrams on-screen with ordinary text. To do so, you'll first type your text as you would any document, and then you'll use function keys to shift to the italic character set for a variable, to boldface for a vector, to math symbols for access to special symbols, and to a miniature character set for subscripts and superscripts.

FONT CAPABILITY *Spellbinder Scientific* offers eight easy-to-use function-key-selected character sets—including ASCII, italic, math symbols, and two sets of

PC MAGAZINE FACT FILE

Spellbinder Scientific,
Version 6.03
Spellbinder Software Products Inc.
P.O. Box 1950
Davis, CA 95617
(916) 758-3630
List Price: $790

Requires: 256K RAM, two disk drives, DOS 1.0 or later.

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chemical symbols. (ASCII, italic, and math symbol character sets may be miniaturized.) Except for a few of the math symbols, these characters may be used as super- and subscripts or may be centered.

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One timesaving feature is *Spellbinder Scientific*'s math edit macro, which simplifies the entry and editing of a mathematical diagram. Several functions identify the top-left and bottom-right opposite ends of an area as a "function box." The macro creates fixed-shape symbols in the appropriate size for the function box, which can be moved, copied, or centered. The macro facilitates the insertion, deletion, replacement, centering, and aligning of text in one term without destroying the alignment of other terms in the diagram. The program also offers a chemical edit macro for formula diagram editing that is similar to the math edit macro. These powerful edit macros make the program a good choice as a secondary word processor for patent attorneys.

CHARACTER EDITOR A character editor lets you alter the appearance of characters; using this feature you can create a new application-specific character set. If you wanted to supplement *Spellbinder Scientific*'s math and chemical symbols with those needed for electronics diagrams, for example, you would be letting yourself in for an extensive undertaking. But developing half a dozen new symbols is a realistic goal.

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—Kenneth H. Werner

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T^3

T^3 (pronounced "tee cubed") is *big*. If you can give it 3MB of disk space and your full 640K of RAM, T^3 can do big things for you. Built-in fonts support scientific, mathematical, and chemical word-processing, Greek and Russian alphabets, and more. If you need symbols not already included in the fonts, you can create your own with the font editor.

If you're familiar with word processing conventions, you may have some unlearning to do before you can use this $595 program from TCI Software Research. Its authors clearly decided to eliminate all assumptions and design the program from the ground up. For example, you can never start a new file in T^3—you must always revise a copy of an existing document. Fortunately, it's easy to create shell documents that contain all the appropriate formatting commands for a business letter or a chemistry text. The program comes with quite a few of these shell documents.

All T^3 files reside in volumes, and each volume is a single DOS file. Within a volume, document names can be up to 16 characters long, and no characters are forbidden. However, you won't be able to manipulate your files with standard DOS utilities.

DEVELOPING HABITS ANEW Your keyboard habits will have to change, too, for T^3 makes extensive use of *chording*. In effect, chording allows any key to act as a Shift key. For example, the "Center" key (5 on the numeric keypad) serves as a "repeat shift." If you press and hold a cursor key, it moves just one space, but if you press Center as well, the cursor moves continuously.

The cursor keys themselves can begin chords. Hold down the Cursor Right key and tap any letter key—the cursor moves right, to the next occurrence of that letter. If you press the Del and move the cursor, the text is highlighted from the point where

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

T^3
TCI Software Research Inc.
1190-B Foster Rd
Las Cruces, NM 88001
(800) 874-2383
(505) 522-4600
List Price: $595

Requires: 640K RAM, hard disk drive, graphics monitor, graphics printer, DOS 2.0 or later

In Short: This massive program should handle any scientific, mathematical, or chemical word-processing job. Not copy protected (U.S. version).

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CIRCLE 211 ON READER SERVICE CARD

you pressed Delete to where the cursor resides. Release it and that text is deleted. While this technique takes some getting used to, it makes the keyboard substantially more flexible.

T^3 uses horizontal-moving-bar menus. They scroll up and down, and you can shortcut them by typing the first letter of the selection you want. Almost any operation in T^3 involves at least one menu. If you need to fill in a blank (for example, a filename, a font, or a keyboard definition), hit the Menu key for a dynamically built list of choices.

MENUS AND MACROS There are so many menus that an experienced user might feel slowed down were it not for the macros. You can create an unlimited number of named macros in T^3. To invoke a macro, hold down Ctrl and type in the name. A T^3 macro doesn't do any conditional branching; it's strictly a recorded sequence of keystrokes. But one macro can call another, and you can edit your macros with a T^3 utility.

For all its flexibility in terms of prepared and user-created fonts, T^3 *does* have some limitations. Delimiters such as brackets have no "stretch"—you build them from smaller pieces, and you must add pieces if your equation grows vertically. Also, the screen display for T^3 is not quite the same as its output. There's no proportional spacing or justification on-screen; all characters line up on columns and half-rows. Fonts don't show on-screen exactly as they will print. Apparently, managing full graphics would have slowed down the program too much.

■ T^3's authors clearly decided to eliminate all assumptions and design from the ground up.

Besides handling your technical work, T^3 has the features typically found in professional word processors that let you create business documents. Business letters printed on a laser printer in a proportional font look very good, and Trigram's *Resident MicroSpell* will make sure they're spelled correctly. TCI also provides "hooks" for Borland's *Turbo Lightning* if you have it.

Don't expect to create complex documents the first day you use T^3. There's a lot to learn, even with help from the supplied Tyro Tutorial. T^3 is immense and very powerful. Its screen display is not 100 percent WYSIWYG, but it's definitely close enough for good work. If you need to work

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on technical documents all day long, T^3 would be a sensible choice.
—Neil J. Rubenking

Tech/Word

With *Tech/Word*, Goldstein Software offers a simple and inexpensive solution to the difficult task of including scientific and mathematical text within a document. The $75 program includes a total of seven special fonts, a normal text font, and the ability to create custom fonts. These built-in fonts, coupled with the program's built-in math structures and symbols, allow you to compose documents in the language of math.

You create a complex equation by keystroking in a series of graphics characters. *Tech/Word*'s mathematical/science expressions are fully WYSIWYG, which spares equation writers the agony of waiting to see hard copy to judge the integrity of an equation. For its low price, even if *Tech/Word* did nothing else but let you type math/science expressions, it would be a useful program.

Tech/Word does considerably more, but not nearly as much as do other scientific-technical word processors on the market. That's because it places a heavier emphasis on the *Tech* component of its name than on the *Word* component. So, while you can create relatively complex formulas and equations, you cannot manage complex documents requiring specific numbering or outlining schemes. It is difficult to size text and equations, and there are no provisions for managing indexes, title pages, tables of contents, tabular materials, or footnotes, all of which are typical requirements of scientific writing.

You cannot easily create multiple margins in a document. There is no drop to DOS, nor is there a way to save the current file with a new filename, resume editing

PC MAGAZINE FACT FILE

***Tech/Word*, Version 1.09F**
Goldstein Software Inc.
12520 Prosperity Dr.
Silver Springs, MD
20904
(301) 622-9020
List Price: $75

Requires: 320K RAM; two disk drives; CGA, EGA, or Hercules graphics card; DOS 2.0 or later.

In Short: This program is an easy-to-use, effective word processor capable of producing a wide variety of scientific and mathematical equations in a painless WYSIWYG fashion. *Tech/Word*'s word processing features are not particularly well suited for managing large documents, but the program may be a terrific solution for short scientific-technical documents. Not copy protected.

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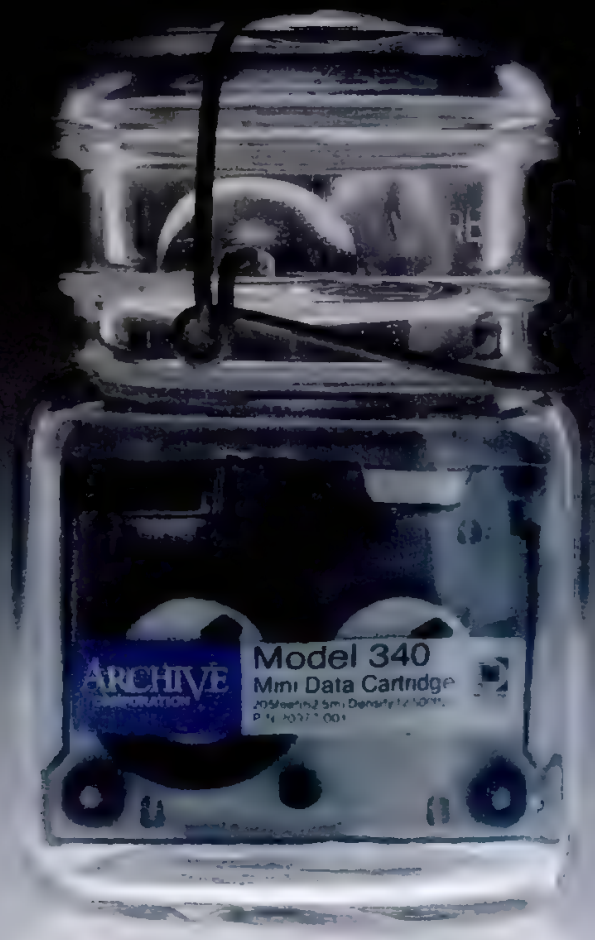

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after a save, create columns, or center paragraphs of text. There's no spelling checker, no thesaurus, no control of backups or a file save procedure, and only a rudimentary search-and-replace facility. Items such as page breaks, page numbering, line spacing, and footers and headers are not WYSIWYG.

Yet, despite these limitations, what exists works well and easily. With the quick reference card and brief tutorial, I was using the program to full capacity after only 30 minutes. However, since the more-complex Alt-, Ctrl-, and Shift-key commands form the bulk of the *Tech/Word* program, since there is no context-sensitive help, and since using the fonts requires mapping the keyboard to other symbols, I usually found myself needing to keep an open manual by my side even after spending days with the program.

■ With the program's quick reference card and brief tutorial, *Tech/Word* can be used at full capacity after only 30 minutes.

When you install the program, you can choose all or some of the built-in fonts. These can be modified and assigned to documents on an individual basis. The main menu is function-key driven and allows you to either edit or print a file or perform some DOS file-management functions.

SIGNS OF AGE The program shows its age when you choose to edit or print a file. It displays an unsorted list of available files. You must type rather than point-and-select the file you wish to edit. Each time you choose a file, you must tell *Tech/Word* to accept or modify your selected default fonts.

Choose edit, and you are brought to a roomy editing screen with a single status line and a ruler line. Alt-Key commands are used to produce different text formats, many of which are displayed in WYSIWYG style on-screen. A series of Ctrl-B commands handles block cut, paste, copy, and save functions. A series of Ctrl-D commands offers a respectable variety of delete-text options, including the deletion of math structures and expressions.

AMPLE TOOLS FOR EQUATIONS Creating equations using *Tech/Word* is a sensible procedure, and you are given ample tools. The function keys define the math structures. Structures describe the look of an intended multiline-height equation. So, for example, you can choose a triple-level I-shaped structure to enter a summation or a triple-level C-shaped structure for integrals. The program also makes it easy to include square roots, radicals, fractions, and matrices within text.

Tech/Word offers eight different math enclosures, including thin and thick brackets, braces, and borders. As you enter information in the bracketed areas, they widen to accommodate these characters. Multiline-height math functions, such as the integral, pi, and sigma symbols and arrows, are also available and are sized to your specifications with a single command.

Combining keyboard commands and special fonts creates the math expression. For a typical equation, you might need a bracket, a "triple double-level super" formation, and keyboard associations entered from any of the three built-in math fonts, a Greek font, two IBM graphics fonts, a script font, a normal font, or a custom-designed font. Two additional fonts for chemical symbols are available free of charge but are not included with the program package.

Creating expressions in this pick-and-choose manner is easy, but there are certain drawbacks. First, these clumps of graphics information can be difficult to edit. As I attempted to edit fractions or move a nested bracket, I often opted to begin from scratch. Second, this graphics building-block approach requires that you must always have the manual or the appropriate help screen displayed. Few users will be able to memorize the keyboard as-

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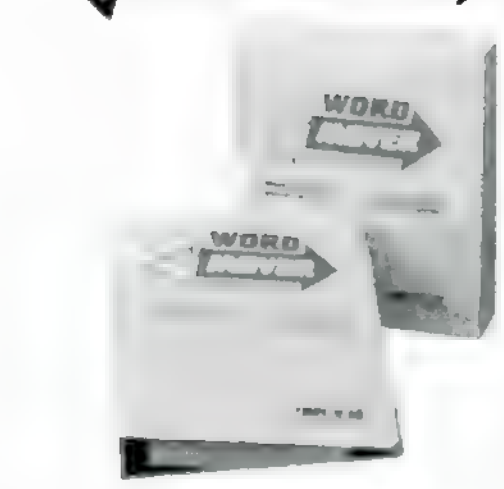

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sociations for all these special symbols. Third, many scientists prefer an English-language "Keyword" approach to processing math expressions because it is less intrusive. The flip side of this is that non-equation-speaking secretarial help seems to prefer the more graphics symbol-oriented solution.

Tech/Word is the offspring of *GoldWord*, which is also an easy-to-use but limited word processor. In fact, it looks as if *Tech/Word*'s scientific and math production capabilities were tacked onto the *GoldWord* processor. Any tailor will tell you that tacking the new onto the old invariably leaves a few seams showing. *Tech/Word* does an admirable job on equations, but it just squeaks by on text processing.—**Robin Raskin**

TechWriter

TechWriter, a $395 technical word processor from CMI Software, is reliable and relatively straightforward to use, even with its few idiosyncrasies. Although it won't do your calculations for you, the package offers a flexible and simple method for producing documents that contain equations—both mathematical and chemical—and it also has a large variety of commands.

Besides the standard ASCII character set, *TechWriter* supports three additional fonts. These fonts include the complete Greek alphabet, as well as an assortment of mathematical, scientific, chemical, text-marking, and script characters.

Among its array of commands, the program uses function-key combinations, Shift/Alt/Ctrl-key combinations, as well as Alt-number combinations. Command sequences often consist of several logical steps. For example, you define a block of text by using the begin block and end block commands. You can then move the block of text with the move block command and clear it with the clear block command.

The template that is included with the package is a vital guide to *TechWriter*'s commands and special symbols. In case you forget how to select an alternate font, a hint on the template instructs you to type the standard character on the alphanumeric keyboard and then press F6 to toggle through the four options for that key. All of *TechWriter*'s 270 special symbols are a single character in height and are clearly displayed on the screen in WYSIWYG format.

EQUATIONS FROM SCRATCH To format an equation that takes up more than one line or that includes an oversized character, you use a special equation block that adjusts the line spacing for oversized characters and protects the equation from being interrupted by a page break. Once you go through a few preliminary steps to define a block, *TechWriter* goes into Math mode, in which you simply enter your equation as it is to appear in print. What you see on the screen is what you'll get on paper. However, it is impossible to see a double bond on a chemical symbol on the screen: this symbol looks the same as a single bond.

One helpful feature is *TechWriter*'s library of glossary, or macro, commands, activated in Math mode, that lets you draw commonly used oversized characters. Among the 20 glossary entries are the integral, radical, and summation signs; large brackets, braces, and parentheses; pi, 60- and 30-degree lines; and the carbon ring.

Once you've made your selection by pressing the Gloss key and typing a one- or two-character specifier, *TechWriter* will ask you to define the character's dimensions. You can then accept the default or specify the appropriate number of lines and columns. The package also allows you to draw carbon rings, convert a single bond to a double bond or vice versa, and *Tech-*

PC MAGAZINE FACT FILE

TechWriter,
Version 3.0
CMI Software
621 Main St., #7A
Waltham, MA 01254
(617) 899-7244
List Price: $395
Requires: 256K RAM, two disk drives, DOS 2.0 or later.
In Short: This is a versatile word processor with many symbols that can be used for writing equations or chemical formulas. It has an extensive command set and supports three alternative fonts. Not copy protected.

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- ☐ **PolyGlot**—Provides a learning environment for basic vocabulatory of several languages
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■ SCIENTIFIC WORD PROCESSORS

Writer lets you draw horizontal, vertical, and angled lines and boxes.

PAGE-BREAK PROTECTION Another exceptionally nice feature of the program is its ability to protect a specified number of lines of a document as a sliding space. This protection could be used, for example, for a figure whose precise position in the text is not important but for which a page break would be unacceptable. The sliding space feature will print the figure on the current page if there is room or it will print it on the next page, pulling with it any lines of text that followed the figure.

On the negative side, *TechWriter* does not support paths, and simple directory features such as COPY or even DIR cannot be accomplished without exiting the document. Nor can you disable automatic backups of documents after a certain number of keystrokes have been made. Consequently, even if the changes made in a session are aborted, the original copy on the disk is still updated.

Even without its technical features, the word processor is very versatile, allowing for unlimited changes in formatting and providing for headers and footers and multiple indexes. Unfortunately, *TechWriter*'s support of columns is weak, since gutter widths cannot be specified and only even-width columns are possible. The program automatically reformats documents most of the time, but it is advisable to use the repagination command when you insert text or change the page numbering. Also, there is no error message when a print request is made while the printer is off-line. And there is no graceful way to abort printing.

TechWriter's documentation is complete and well above average. Once you manage to find information on a particular subject, it is clear and well explained; however, you may have to do some searching since the information you need might be scattered in several places. In addition, the documentation does a poor job of assisting you with the choice of suitable drivers for the more than 100 printers that *TechWriter* supports. The package's concise Quick Study Guide, concise containing pertinent examples, will get you off to a flying start.

Overall, *TechWriter* is pleasant to use and fully functional for most purposes. It is a good choice for users who are looking for a straightforward and painless way of creating technical documents.

—Caroline Halliday

Total Word

Lifetree Software's *Total Word* has a rich assortment of features, making it more than a typical word-processing program. It can capture and use graphic images, preview a full page, use different font styles and type sizes, and build equations or chemical diagrams using over 400 scientific characters. Plus, typical word-processing features are abundantly present in a mix of menus, function-key commands, and Shift/Alt/Ctrl-key combinations. Priced at $495, *Total Word* is a very full-featured program.

One of the pleasures of *Total Word* is learning it. Lifetree has produced an excellent manual and on-screen tutorial program. The tutorial helps you explore most of *Total Word*'s features in four lessons.

The main menu in *Total Word* has the look of *Volkswriter*, another of Lifetree's products. The top fifth of the screen lists 14 functions that are invoked by a single letter. These functions include retrieving,

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

***Total Word*, Release 1.0**
Lifetree Software Inc.
411 Pacific St.
Monterey, CA 93940
(800) 543-3873
(800) 831-8733 (in Calif.)
List Price: $495
Requires: 480K RAM, hard disk drive, DOS 2.0 or later.
In Short: A very full-featured package, *Total Word* offers over 400 scientific characters for creating equations and chemical structures, a range of fonts and type sizes, the ability to capture and use graphic images from other programs, and powerful, elegant formatting features. In addition, it contains typical high-end word-processing features such as a spelling checker, a thesaurus, math functionality, nonprinting comments, and indexing. Not copy protected.

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creating, storing, and renaming a document and printing. The rest of the screen holds a list of files. You can retrieve these files by name or by pointing to them with the cursor and then pressing Enter. After you open a file you can use the program's scientific characters by calling up one of nine special, on-screen "keyboards." Pressing Alt-K pops up a menu window of keyboards across the top of the screen. The choices include Business/Bullets/Rules (Alt-2); Math/Logic/Sets (Alt-4); Subs & Supers/Math (Alt-5); Greek (Alt-6), and Organic Chemistry (Alt-0).

KEYBOARD DIAGRAMS When you select a keyboard, it appears at the top of the screen as a box diagram showing the alphabet keys as they appear on a typical keyboard. Each key box shows the appropriate letter and one or two symbols that can be printed by pressing the key alone or with the Shift key. For example, you can type the small integral symbol by pressing the F key on the Subs & Supers/Math keyboard, then switch keyboards and type the not-equal symbol by pressing Shift-G on the Math/Logic/Sets keyboard.

Scientific characters can be used only if you have a Hercules board or an EGA, VGA, or MCGA board. To print the special characters, you need a Hewlett-Packard LaserJet or compatible or a PostScript printer.

Using the scientific characters to build often-used equations or drawings of chemical compounds can be done with macros. The macros menu will pop up if you press Alt-M. Recording a macro is as simple as pressing R, then running through the right keystrokes. Macros are used to record building-block pieces of equations or diagrams, making it simple to create complex formulas or structures. Macros also do more mundane work, like inserting a trademark symbol or the Italian lira sign.

CAPTURING IMAGES Creating a scientific document involves more than just typing equations or diagrams. You might also want to incorporate special graphics material from other programs. You can capture these images from the screen by using a *Total Word* utility program, called Snapshot. First you have to exit the main *Total Word* program and go to the \TOTALPGM subdirectory to load Snapshot. Then you go to any other graphics program screen to capture your image using the Ctrl-Alt-Q combination. A thin frame will appear around the image to permit cropping. The cropped image can then be dropped into a text document at any point. It can extend from the left margin to the right margin or can be sized by percentages. If you choose a smaller size, the image can be placed flush-left, flush-right, or centered. You can also put a border around it, reverse the black and white portions, and adjust the balance of black and white

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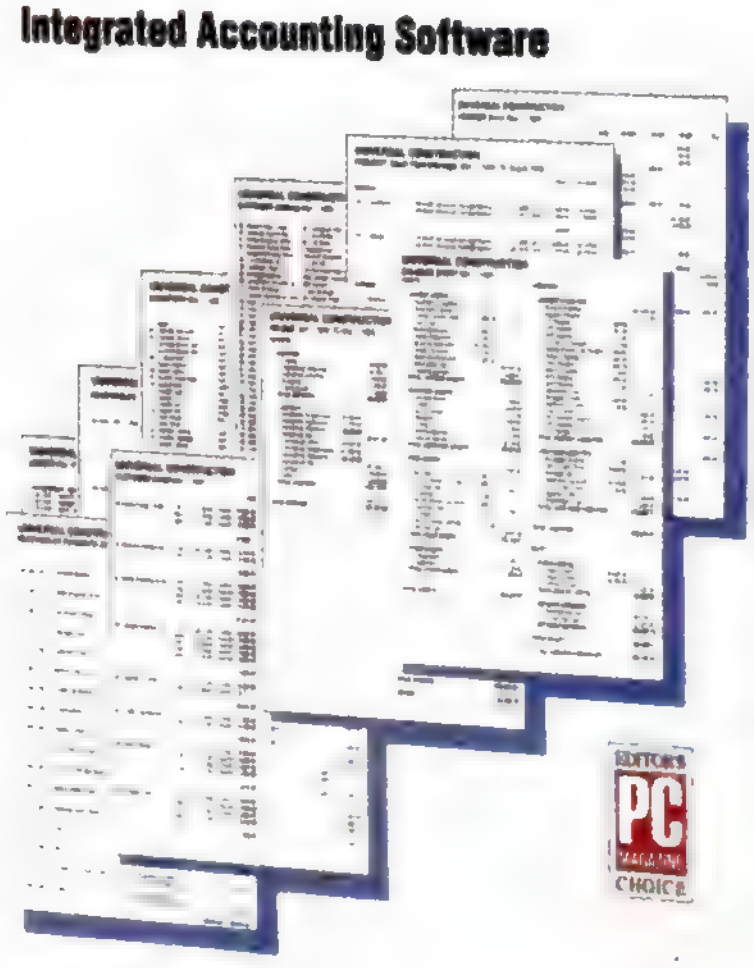

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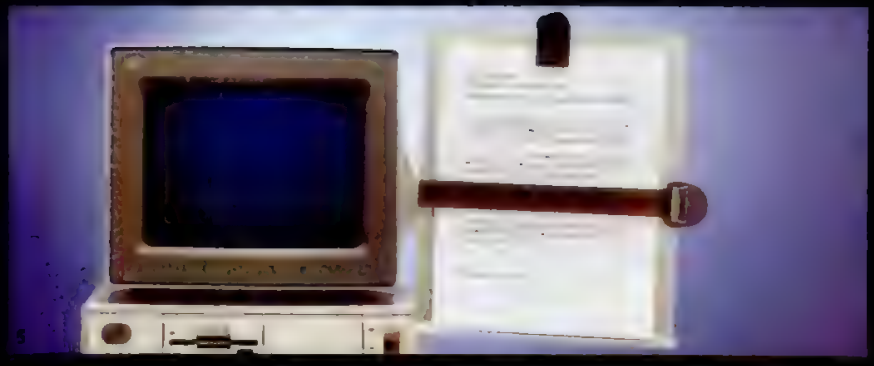

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with an exposure setting.

The graphic image itself will not appear on the document screen. You can view it at the graphics menu to be sure it's the right image, but it appears in the document as a command line. Through *Total Word*'s page preview function, you can see how much vertical space it will take up on a page or in a column, but the left/right size won't show, nor will the border.

Previewing a page is very useful for getting an overall feel for the look of a format, but unfortunately that's all. The type is generally unreadable, font styles won't show, and subtle changes in point size can't be made out. A close-up option in preview mode will display a portion of the page as it will print, but the type is very blocky. However, in this close-up view, you can see the scientific, boldface, and italic characters—all in relative size and readable.

ROBUST FORMATTING FEATURES

One of the more-powerful aspects of *Total Word* is its formatting abilities. You can change the format of a document line by line by using section layouts. Each section

PC MAGAZINE EDITOR'S CHOICE

- **T^3**
- **Total Word**

If you need the extra functionality that scientific-technical word processors offer, in many cases you may have to sacrifice speed or standard WP features. For example, TCI Software Research's T^3 *($595) was one of the slowest programs we evaluated, but it is strong on alternate character sets, offering mathematical and chemical symbols as well as the Greek and Russian alphabets. If you need special symbols that* T^3 *does not include, you can use its font editor to create them. Standard document control commands and a spelling checker, which typify corporate word processors, are also part of* T^3*'s repertoire.*

Lifetree Software's Total Word *($495), the successor to* Volkswriter *and* Volkswriter Scientific, *goes even further than* T^3 *in bridging the gap between the worlds of corporate and scientific-technical word processing. The package has several alternate keyboards and a full range of typical word-processing features, including a spelling checker and a thesaurus, indexing, nonprinting comments, mail-merge, and automatic hyphenation. Not only does it give you access to over 400 scientific characters, but its Snapshot program lets you capture graphics from other programs, making it useful as a desktop publishing tool.*

Groucho Marx's statement "I wouldn't want to belong to any club that would accept me as a member" could apply to our contention that Lotus Manuscript *is a strong contender for Editor's Choice—despite the fact that Lotus no longer wants to market the package in this product category. In fact, had* Manuscript *not been between versions during our evaluation, it would have been an Editor's Choice. That* Manuscript *excels at handling large documents and could go up against any corporate-level word processor is undeniable. Moreover, its equation language, which lets you enter equations by using descriptive English-language keywords, is one of the most commonsense approaches to mathematical keystroking we've seen. If you're writing a long, highly structured document replete with equations, tables, footnotes, and indexes,* Manuscript *is worth considering.*

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layout lets you set line spacing, lines per inch, tabs and margins, justification, and the number of columns. Once you create a section layout, it can be used anywhere in a document; existing text can always be reformatted later if you want to apply a different layout.

By using section layouts—which are indicated in a status area at the bottom of the screen—you can instantly change groups of format parameters. For example, you might go from an indented, nonjustified line of text 75 characters wide, with 12 on 13 leading, to two columns of text 35 characters wide, right justified and with 12 on 12 leading, just by pressing three keys in rapid succession.

Besides creating a section layout, you can create a single page layout that specifies parameters for such elements as continuous paper form or single sheet, paper length, paper width, top and bottom margins, pagination, line numbering, and others. The page and section layouts are saved with the document, and you can have up to 255 different section layouts for each document.

By giving your document a file extension, you create a style sheet—a combination of section layouts and a page layout—that is available every time you start a new document with the same file extension. Style sheets make it incredibly easy to produce consistent-looking reports, scientific manuscripts, memos, letters, and legal documents. And yet, layouts can be changed for an individual document without affecting the style sheets.

Section layouts can also specify type styles. *Total Word* lets you control all the resident fonts, as well as fonts from cartridges and downloaded fonts that a printer contains. You can even create a new type style by choosing the size, weight, and style of the characters from the available typefaces and then selecting certain characteristics to emphasize, underline, change in color (if your printer has color), and shadow. The type style can be changed at any point and for as much text as you wish, regardless of the prevailing type style in the section layout.

Total Word has a host of other features typically ascribed to quality word-processing packages: a spelling checker (with 170,000 words); a thesaurus (with 300,000 words, including synonyms and antonyms); indexing capability; mail-merge; a full range of editing, copying, moving, and deleting functions; search-and-replace; headers, footers, and footnotes; automatic hyphenation (in a user-definable zone); a split-screen mode; basic math functions; word count, nonprinting comments, and on and on. In short, there is little if anything missing from this full-featured word-processing package.

—Henry Fersko-Weiss

WordMarc Composer

WordMarc Composer, from Marc International Software, is a comprehensive word processor designed for technical and scientific document preparation. With easy access to three different technical character sets and multilingual character formatting, the $375 program also includes some of the most complete and precise documentation you'll find.

In addition to running on PC-compatible micros, *WordMarc Composer* is avail-

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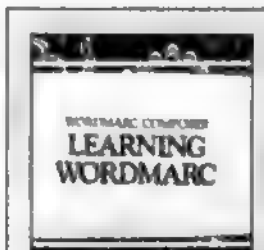

***WordMarc Composer*, Version 86.0908C2**
Marc Software International Inc.
260 Sheridan Ave.
Palo Alto, CA 94306
(415) 326-1971
List Price: $375

Requires: 512K RAM, hard disk drive, DOS 2.0 or later.

In Short: A comprehensive word processor designed for scientific-technical documentation across a number of micro and minicomputer environments. However, its on-screen text-formatting interface may limit its appeal to nonscientific professional users. Not copy protected.

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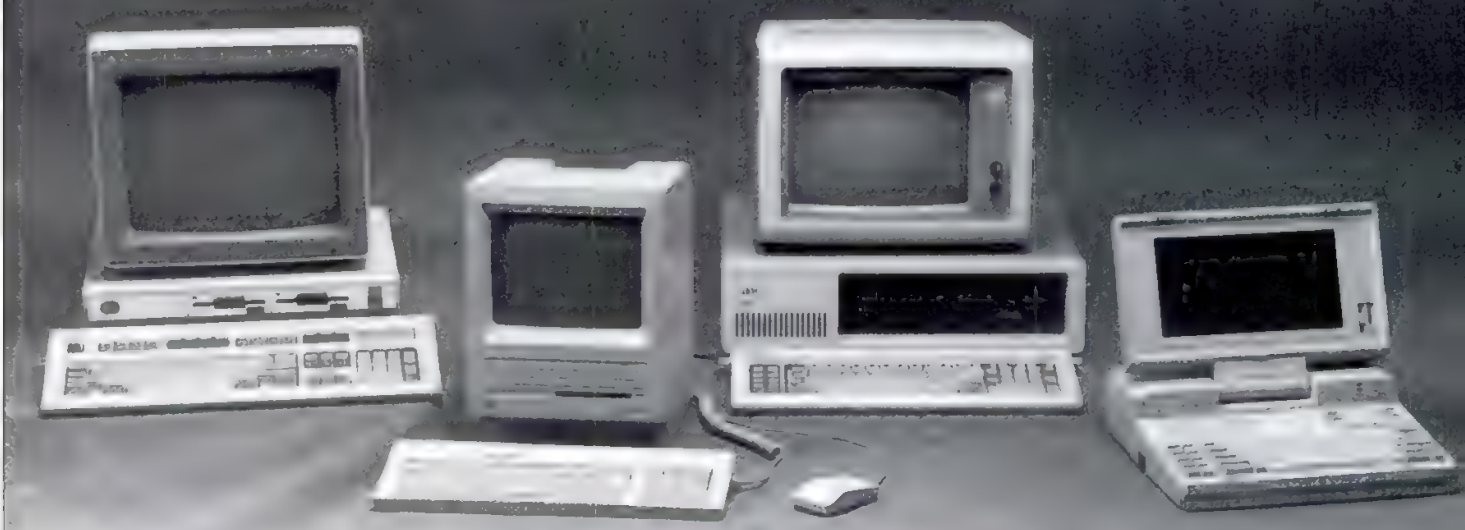

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■ SCIENTIFIC WORD PROCESSORS

able for a wide variety of Unix-based minicomputers, including ones from Sun, Apollo, AT&T, and Prime and the DEC VAX. Since the package includes telecommunications and file transfer capabilities, the PC version can send copies of a document directly to a minicomputer host.

That's the good news. Unfortunately, the screen interface, apparently written to accommodate a variety of video terminals (which makes it easier to move the software to other computers), is sadly lacking when compared with the current crop of WYSIWYG word processors. While this could not be overlooked if the package were targeted at corporate users, the package's strengths in scientific and technical document preparation make its interface tolerable.

THOROUGH DOCUMENTATION *WordMarc Composer*'s almost excruciatingly thorough documentation includes five manuals, each one representing a different level of expertise. A map in the front of each shows its position in the hierarchy and contains a brief description of all of the manuals. Novices will be taken smoothly through each step of using the program, but more-experienced users can skim the first two manuals and get right into advanced document preparation.

The technical reference manual tells you everything you want to know about the product. With detailed sections on the file formats used and on creating your own printer drivers (using English-language descriptions), you'll wonder if the source code for the product was included, too. And while Marc International offers technical support for $50 a year (90 days free), you probably won't need it in light of the comprehensive documentation.

Installing *WordMarc Composer* is a snap. The installation program can be rerun at any time, to accommodate a change in monitors or a switch to either a different technical character set or another set of printer drivers. (Up to ten are available at a time, and over 170 drivers come with the program.)

In addition, the installation program is among the most intelligently written ones I've seen. Not only did it ask permission before making changes to my AUTOEXEC.BAT and CONFIG.SYS files, but it was also smart enough not to make changes where my current configuration was sufficient.

WordMarc Composer has three technical character sets available: Greek, chemical, and DecTech. In addition, the conventional English alphabet can be modified to reflect European punctuation with a few keystrokes. Any monitor can be used, with the exception that computers using monochrome monitors require an EPROM from the vendor to generate the technical characters (but the European punctuation is still available without an EPROM).

Unlike most mainstream editors and word processors, *WordMarc Composer* does not strictly follow convention in its use of the PC editing keys. While this may limit its appeal to some users, several templates, guides, and diagrams displaying the keyboard configuration are provided.

WordMarc Composer is not a WYSIWYG word processor—a shame, since it handles scientific and technical text so well. Almost all on-screen document-formatting capability revolves around the use of a "format line," which is a ruler line that controls all text following (until another format line is encountered). An unlimited number of format lines can be used to control any text of any size.

Users who are accustomed to typesetting environments may find this helpful, but it does disrupt the screen. There also is a preview capability, which will display a formatted document on the screen as an alternative to printing it.

UNINTEGRATED FUNCTIONS The processes of designating, moving, copying, and deleting objects while editing are not well integrated. Each one is separate and requires you to place your cursor at one end of a block of one or more characters, specify the operation (move, copy, erase), designate the remaining text, and press the "execute" key (Plus on the numeric keypad).

WordMarc Composer is also unable to perform point-and-shoot operations on text objects. Text objects as such (words, lines, sentences, and paragraphs) are unknown to *WordMarc*, and there is no way to designate a piece of text without moving the cursor over its characters or lines. Nor can you designate an object from its mid-

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dle. For instance, you must move the cursor to the beginning of a paragraph, specify the operation, and then move to the end.

Another annoying feature of editing a document with *WordMarc Composer* is its default overstrike mode. There is no insert mode as it is known elsewhere. *Everything* can be overwritten almost all the time. To insert text, you must position the cursor, press the Ins key, insert the text, and press "execute." Then you are returned to overstrike mode. To insert text elsewhere, the process must be repeated.

What must also be noted is that a limited on-line help facility is available, and that *WordMarc Composer* has a very powerful macro capability. The Undelete function, in fact, is actually implemented as a macro.

In all fairness, Marc International has slated the release of a major upgrade, *WordMarc Composer Plus*, to be available by the time this review hits the newsstands. Some if not all of the weaknesses of the current product may be remedied in the new version.

■ Unlike most word processors, *WordMarc Composer* doesn't strictly follow convention in its use of the PC editing keys.

WordMarc Composer Plus, according to the vendor, will include text-sorting capabilities; an on-screen calculator; an overstrike/insert mode toggle (relieving the current overstrike-only problem); an enhanced dictionary (over 100,000 words); a spelling checker that operates while you edit; 20 different additional type styles; the ability to integrate graphics, Lotus .PIC files, and PostScript files; complete PostScript laser printer support, and automatic pagination and reformatting. The maximum right margin will be increased to 254 characters, line spacing will be able to be fine-tuned in increments of 1/100 inch, and extensive automatic date capabilities will be added. The new version will also let you convert documents to *Ventura Publisher* format.

Overall, the on-screen formatting interface is the only real stumbling block for this otherwise complete and comprehensive word processor. Despite this weakness, it is a strong contender in the scientific-technical document-preparation marketplace.—**Richard Hale Shaw** PC

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*InfoWorld, December 1987.

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■ **PC LAB NOTES:** REFRESH UTILITY ■ BRIAN K. ROEMMELE

INSTANT SPEEDUP FOR YOUR PC

This simple software technique squeezes more speed from your memory. Postponing the refresh cycle lets your PC spend more time computing.

You can learn a lot about how your PC works by studying the IC data books published by the manufacturers of its chips. While much of the material in such publications is agonizingly technical, you'll often turn up valuable tidbits that never found their way into IBM's *Technical Reference* manuals. I used this information, along with some further detective work (perusing the ROM BIOS listings), to develop a simple software technique you can use to speed up your computer.

Most PC compatibles today use VLSI (Very Large Scale Integration) chip sets, such as those produced by Chips and Technologies. A VLSI chip gathers the functions of many originally separate chips into one. In most cases, however, these large chips duplicate even some of the originally undocumented functions as well. What can complicate matters even further is that the VLSI chips may also include features that are not widely known.

You can look at a chip manufacturer's specifications and recommendations in two distinctly different ways. When designing a computer, it's a sound engineering practice to choose chips and components whose *average* ratings (as published by the manufacturer) meet your system's *worst-case* requirements. That way, when the system goes to production, all operations will be well within the capabilities of the chips.

But I spend most of my time finding the *maximum* limits of many chips in PCs. Since I'm dealing with an already-manufactured product, such as the IBM PC AT, I use the manufacturers' suggested maximum ratings for each chip as a starting point to experiment. Analyzing the original IBM PC AT in this way led me to discover that the CPU's crystal frequency could be increased by a huge amount with no adverse side effects.

Remember the V20? No, not the rocket. The redesigned and enhanced 8088 work-alike microprocessor from NEC. Just pop out the Intel unit, drop in the V20, and you could (and still can) realize anywhere from a 5 to 30 percent overall speedup in most applications. And testing the effect was easy—either you noticed a faster PC or you didn't. Needless to say, the V20 became a very popular upgrade (much to the dismay of Intel).

It's time now to add another speed booster to the list—though this time you do it in software. You can pep up the old PC again just by reducing the refresh rate. But before I show you how, let me tell you why it works.

REFRESH MY MEMORY PCs, XTs, ATs, and most compatibles use Dynamic Random Access Memory (DRAM) chips for their 640K main memory. DRAM is very popular among PC designers because the chips have a low cost per byte and tend to share timing and voltage requirements with most Intel chips.

DRAMs may be thought of as a vast array of capacitors laid out in rows and columns. The capacitors in the DRAM have two usable states: charged (a binary one) and discharged (a binary zero). Because of their design, these capacitors can hold their charge only for a relatively short period of time. If the charge goes away, so does the data. To recharge the capacitors, therefore, the DRAM must be accessed periodically. This access is called a *refresh*.

PRODUCTIVITY INDEX

PC LAB NOTES
How reducing your chips' refresh rate can boost computing speed.
UTILITIES
SETMODE makes it easy to set your video mode and COM port parameters.
ENVIRONMENTS
A look at the OS/2 1.1 Presentation Manager and its graphical interface.
POWER PROGRAMMING
Changing incomplete filenames to fully qualified drive-and-path form.
SPREADSHEET CLINIC
Undocumented Query key method that lets you edit records instantly.
USER-TO-USER
Preventing DOS's APPEND command from destroying files.
POWER USER
Finding current drive and directory from *Clipper* and *dBASE III Plus*.
LANGUAGES
A simple program to merge C and assembler code listings.
PC TUTOR
Understanding bad sectors on hard disks; patching REMOVE.COM.
CONNECTIVITY CLINIC
Finding ARCnet's station address with BASIC and Ethernet's with C.

■ **PC LAB NOTES**

The system hardware performs a refresh on a regular cycle to keep the data stored in the DRAM valid. It's important that the refresh cycle take place before the DRAM begins to discharge, or the data stored there will become corrupted. Another type of RAM, Static Random Access Memory (SRAM), on the other hand, doesn't require any refresh cycle. (See the sidebar "DRAM Versus SRAM" for further information on this different type of memory chip.)

WAIT STATES Don't confuse memory refresh with a memory *wait state*. A wait state is a technique used to slow down the CPU when it can receive data faster than the memory can fetch it (the rated access time). The original IBM PC AT, for example, had an 80286 CPU running at 6 MHz. For many unfortunate reasons, IBM used a wacky "piggyback" RAM arrangement custom-made for the AT. At that time, the 64K chips used to build the 128K piggyback RAM chips were available at only 200- and 250-nanosecond access speeds.

The 6-MHz AT has a clock cycle of 1/6 MHz = 167 ns. The installed RAM, however, was rated for a 200- or 250-ns. access time. To run at 6 MHz with no wait states, RAM with an access time of less than 167 ns. would have been required. So, the AT wound up with hardware that would produce one wait state for all memory on the system board to compensate for the fast CPU speed and slow RAM.

TIME TO REMEMBER The DRAM refresh cycle is performed automatically by a combination of two chips: the 8253 Counter/Timer and the 8237 Direct Memory Access (DMA) Controller. The hardware for this process is shown schematically in Figure 1. The DMA controller performs the actual refresh by reading all the memory locations and recharging the capacitors. (The IBM PC AT DMA hardware is constructed a bit differently and uses an 8254 Counter/Timer chip, but for our purposes it is functionally equivalent to the PC.)

The 8253 Timer Chip contains three separate timers. Timer 0 produces the system "hardware timer tick" that drives the BIOS time functions. Timer 1 is responsible for controlling the length of the period between DRAM refreshes. Timer 2 can be connected to the PC's speaker to give it a primitive sound-producing ability.

The refresh timer counts down from a programmed value, placed there by the BIOS, until it reaches zero. At that point, it notifies the DMA to start the refresh cycle

DRAM VERSUS SRAM

Dynamic Random Access Memory (DRAM) chips are the popular choice for memory storage on PCs. That's partly because they're less expensive per byte than their logical competitor, Static Random Access Memory (SRAM) chips. The DRAM design essentially requires using one transistor per bit. The immediate benefits of this are higher memory density and better use of the chip's silicon real estate. SRAM, by contrast, requires about eight transistors per bit. This means that fewer bytes of storage can be constructed per chip. Further, the more complex circuit causes a larger power consumption per byte.

If DRAM chips pack more memory per square inch and use less power, why is SRAM still around? Part of the answer lies in examining how the DRAM's single transistor per bit works.

The transistor used in the DRAM acts much like a capacitor that can temporarily store a 1 or a 0. But because a transitor makes a lousy capacitor, it loses its charge rather rapidly. DRAM is nothing so much as a leaky bucket that must be constantly refilled.

A circuit using DRAM requires refresh circuitry and some portion of the system's operating time to perform the refresh. In addition, the computer must deal with the delays encountered before DRAM can be read from or written to. Why, then, is DRAM still around? As in any design, power consumption, cost, and speed must all be considered individually.

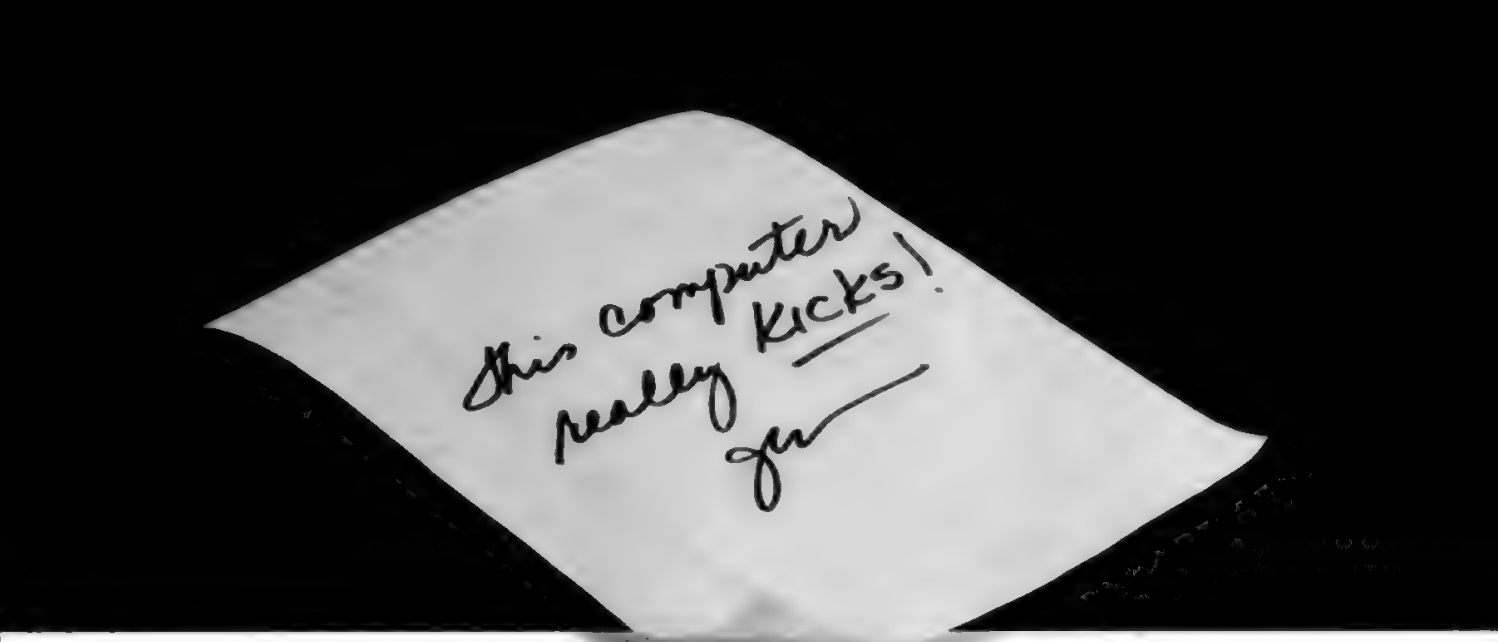
SRAM, on the other hand, is a more complicated circuit. One bit of storage is implemented as a flip/flop circuit which can be set to a 1 or a 0. The flip/flop remains in position until power is completely removed or until it is changed by storing a new value. Unlike the DRAM, no refresh cycle is needed; thus, no wasted time. The SRAM chip can be thought of as an array of on/off switches. Contrast that with DRAM, which will be fully corrupted if left alone too long.

Could you replace DRAMs with SRAMs to increase performance? Unfortunately, no. DRAM chips are not interchangeable with SRAM chips. They have vastly different support circuit requirements, and the pin assignments of comparable chips do not reasonably coincide. Simply plugging in SRAMs to increase performance is not possible.

To realize the best of both worlds, however, SRAMs *are* being designed into some PCs to complement DRAMs. When part of an original design, the individual characteristics of both types of RAM can be fully exploited. A few thousand kilobytes of SRAM are used to buffer large amounts of slower DRAM. The system can then match the high-speed I/O of the CPU with SRAM, while leaving the slower DRAM to catch up. In some cases new PCs are using SRAM exclusively to gain every edge in the race for higher performance.

The SRAM chips being manufactured today (for tomorrow's designs) promise lower power consumption, acceptable memory densities, and the ability to work with much faster CPUs. Exotic relatives of SRAMs are even finding their way into superfast 386-based systems.

The benefits of using SRAM and/or DRAM are beginning to converge. We'll see more PCs introduced using SRAM or SRAM and DRAM combinations, but it will be some time before the raw memory densities of cost-effective DRAM will be surpassed.—**Brian K. Roemmele**



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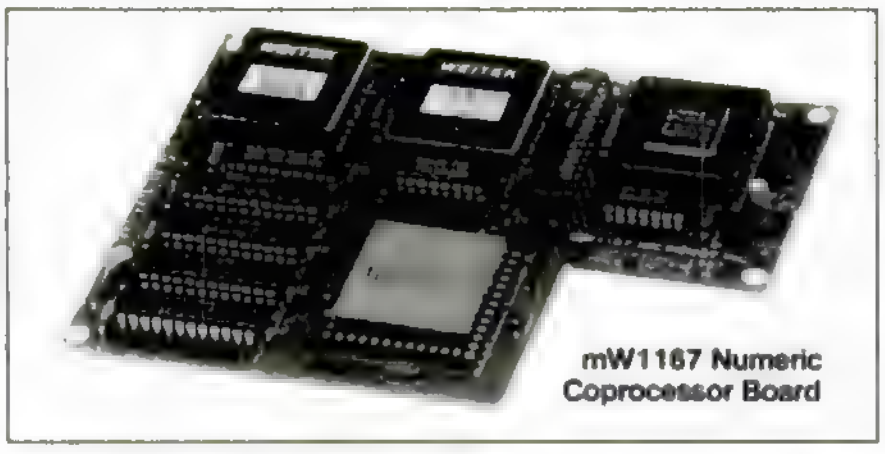

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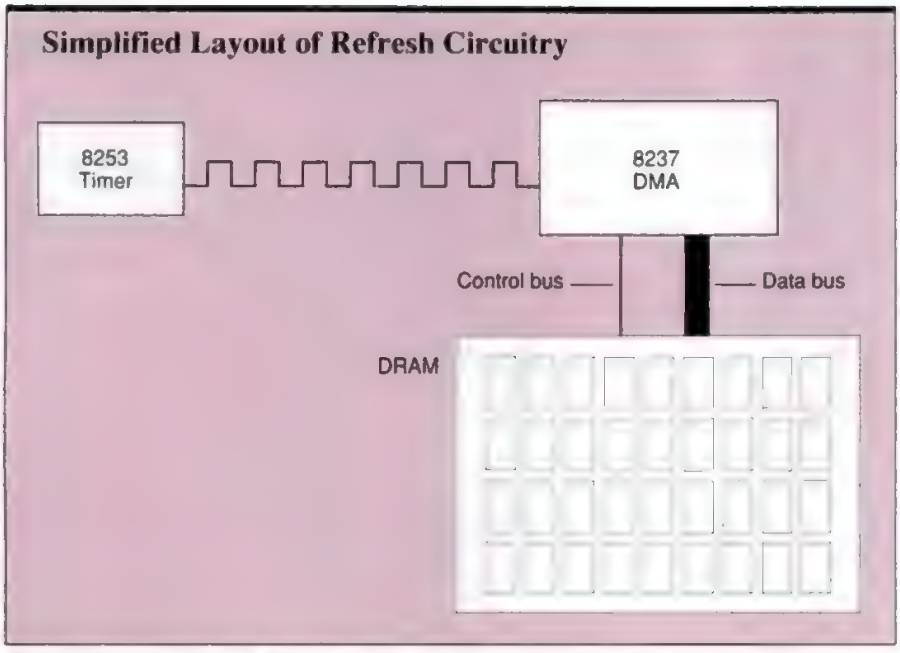

Figure 1: *This simple block diagram shows the fundamentals of the refresh circuitry.*

and begins counting down again. Once it has been initiated, refreshing the DRAM assumes the highest priority: it takes precedence over all other system activities. Each refresh cycle exercises a single 64K block of system DRAM. So, a system with 640K of DRAM would require ten refresh cycles to refresh the entire memory space. This cycle is repeated continually as long as the system is operating.

TALK TO MY REGISTERS The DMA and 8253 Timer chips use registers to communicate with the outside world. The registers are mapped into the PC's input/output (I/O) address space, which allows us to access them directly with simple commands. This direct line of communication will let us alter the value of any writable register. (Some registers are "read-only" and don't allow this.) In most cases, a register's value can be read as well. (In the case of the timer chip, the register contains

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PC MAGAZINE

HELP FILE

Volume 7
Number 13
July 1988

BASICA 3.x Identifiers

This Help File lists standard identifiers for Advanced BASIC 3.x. Some of these commands will not work in Cassette or Disk BASIC, in the BASIC Compiler, or in previous versions of Advanced BASIC.

IBM-compatible computers require their own versions of BASIC, e.g., GW-BASIC. Most of the identifiers listed here will also correspond to these other BASIC versions, but some may not.

**SYNTAX: BASICA [*filename*] [<*input*] [>]
[>*output*][/F:*files*] [/S:*bsize*] [/C:*combuffer*]
[/M:[*max workspace*][,*max blocksize*]] [/D]**

filename = BASIC program file to load and run
input = file or device for redirected input
output = file or device for redirected output
files = number of files that can be open at once. Default 3. Maximum is number specified in FILES= line of CONFIG.SYS minus 4.
bsize = buffer size for random files. Default 128 bytes. Maximum 32767 bytes.
combuffer = receive buffer size for communications. Default 128 bytes. Maximum 32767 bytes.
max workspace sets space allocated for BASIC data and stack segments. Default 64K.
max blocksize reserves space for assembly routines above highest location BASIC can address (65536).
/D makes double-precision math functions resident.

BASIC identifiers are variables, functions, statements, and commands. Variables are available for your examination and use. Functions return a value based on zero or more arguments. Statements and commands both perform an action, but in general you use statements within programs and commands in direct mode.

BASIC Functions

Arguments for BASIC functions:
bytenum: A numeric constant, variable, or expression in the range 0..255.
dummy: Dummy numeric argument.
filenum: The number with which the file in question was OPENed.
number: A numeric constant, variable, or expression.
offset: An offset from 0 to 65535 in the current segment. Set the current segment with DEF SEG.
string: A string constant, variable, or expression.

ENVIRON$ — String from BASIC's environment
SYNTAX: ENVIRON$(*string*)—or—ENVIRON$(*n*)
string = name of parameter to be retrieved (case sensitive)
Returns the value of the named parameter.
n = number of parameter to be retrieved (1..255).
Returns both the parameter and its value.

EOF — End of file
SYNTAX: EOF(*filenum*)
Returns -1 (TRUE) if at end of file, 0 (FALSE) if not.

EXP — Exponential operator
SYNTAX: EXP(*number*)

FIX — Truncate number to integer
SYNTAX: FIX(*number*)

FRE — Number of unused bytes in BASIC data area
SYNTAX: FRE(*dummy*)—or—FRE(*string*)
string = a dummy argument. FRE will compress the data area if you use a string variable as the argument.

HEX$ — Convert number to hexadecimal string
SYNTAX: HEX$(*number*)
number = -32768..65535

INP — Read a byte from a port
SYNTAX: INP(*n*)
n = 0..65535

INPUT$ — Read a string of *n* characters
SYNTAX: INPUT$(*n*[,[#]*filenum*])
n = number of characters to be read from the file
NOTE: If *filenum* omitted, reads from keyboard.

INSTR — Position of one string in another
SYNTAX: INSTR([*n*],*string1*,*string2*)
n = starting position for search in *string1* (1..255). Default 1.
string1 = string to scan
string2 = string to search for

INT — Convert to integer by rounding down
SYNTAX: INT(*number*)

IOCTL$ — Read control string from device
SYNTAX: IOCTL$([#]*filenum*)
NOTE: Can be used to determine if an IOCTL statement has succeeded or failed.

LEFT$ — Leftmost *bytenum* characters of string
SYNTAX: LEFT$(*string*,*bytenum*)

LEN — Length of string
SYNTAX: LEN(*string*)

LOC — Current position in file
SYNTAX: LOC(*filenum*)

LOF — Length of file
SYNTAX: LOF(*filenum*)

LOG — Natural logarithm
SYNTAX: LOG(*positive number*)

LPOS — Position of printhead in print buffer
SYNTAX: LPOS(*n*)
n = printer number (1..3). 0 also valid for LPT1.

MID$ — Extract part of a given string
SYNTAX: MID$(*string*,*start*[,*length*])
start = 1..255. Character position to begin extracting.
length = 0..255. Number of characters to extract. Default remainder of string.

MKD$ — Convert double-precision to string
SYNTAX: MKD$(*double-precision*)

MKI$ — Convert integer to string
SYNTAX: MKI$(*integer*)

MKS$ — Convert single-precision to string
SYNTAX: MKS$(*single-precision*)

OCT$ — Convert number to octal string
SYNTAX: OCT$(*number*)
number = -32768..65535

PEEK — Read byte from memory
SYNTAX: PEEK(*offset*)

—Neil J. Rubenking

This is the third in a series of Help Files about BASIC.

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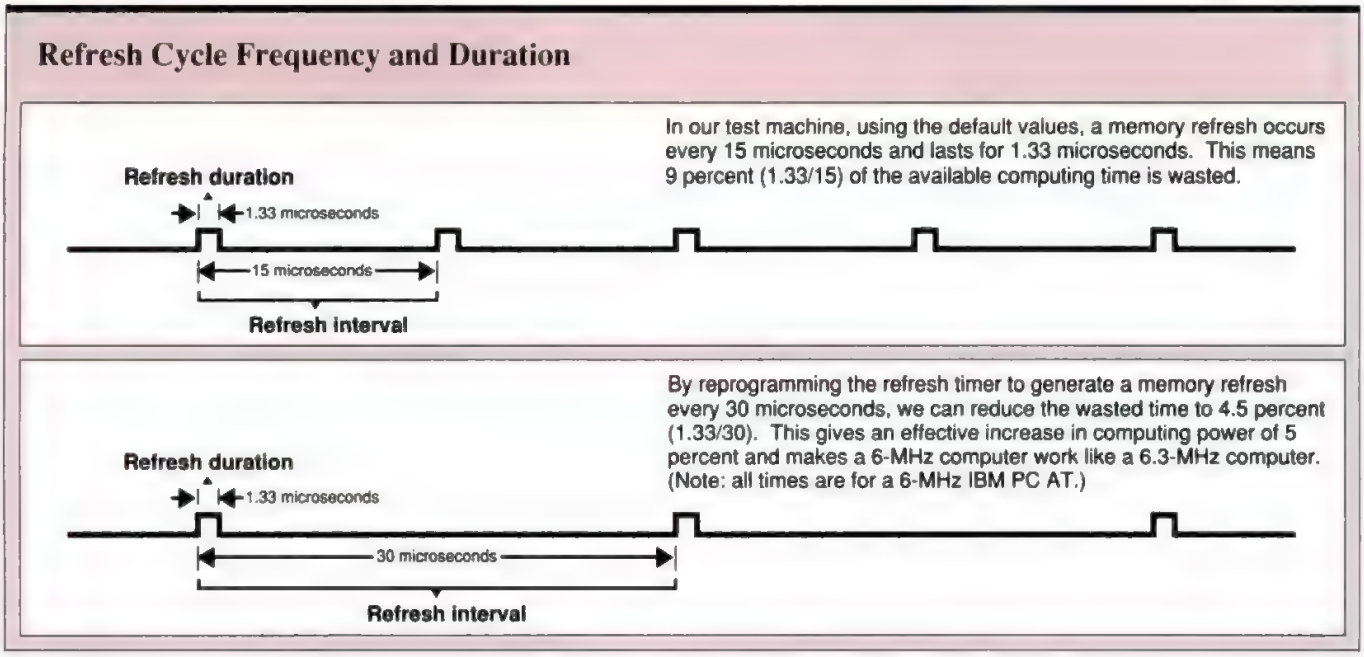

Figure 2: *The efficiency increase available by changing the refresh is easily calculated as illustrated above.*

the value of the countdown timer, and the readings will be constantly changing.)

By storing a new value for Timer 1 of the 8253 Timer chip, we can increase or decrease the time period between refreshes. This is important because the refresh cycle can account for anywhere between 9 and 20 percent of the system overhead. Increasing the amount of time between refreshes gives us proportionately more time for computing, thereby boosting performance. The diagram in Figure 2 shows an example of how this works. By removing some of the system overhead, you can free up more time for the CPU to spend computing and, in turn, run your software noticeably faster.

SETTING THE TIMER When a PC is turned on, one of the first tasks the ROM BIOS performs is to set the refresh cycle timer and test all available system RAM. The procedure leaves the value 12h in I/O register location 41h, which is the location of the 8253 Timer register that controls the refresh frequency rate.

The designers of the PC determined its required refresh cycle by matching the RAM chip manufacturers' average cycle recommendation. This refresh value is based on a theoretical average condition that the manufacturers estimated would be necessary for their DRAMs to operate reliably. But it's common practice in the electronics industry for manufacturers to publish underrated specifications for a chip. This allows the quality of chips to vary slightly while still meeting the specification.

■ It's important to note that the quality of the installed DRAM chips—and whether you're using a PC, XT, or AT—has much to do with how long you can put off refresh.

Because of this conservative approach, it's not unusual to find that the time between refreshes can be substantially increased without any ill consequences. Of course, there *is* a limit to how long we can put off refresh, but it tends to be far beyond the manufacturers' stated maximum.

On one test machine, for example, I was able to stretch the refresh interval from its normal value to 1.001 seconds. This reduces the refresh overhead to less than 0.2 percent and results in an overall performance increase of almost 29 percent! An interval of 1.001 seconds is incredible when you consider that on most PCs the standard refresh cycle is performed once every 15 microseconds.

It's important to note that the quality of the installed DRAM chips—and whether you're using a PC, XT, or AT—has much to do with how long you can put off refresh. It also influences just how much of a boost in performance you'll see. I've done most of my testing on IBM PC ATs and AT compatibles. The CPU speeds and wait states varied. The DRAM chips were made by NEC or Toshiba and were rated at 100- or 120-ns. access time. ATs with 100-ns. RAM and CPUs over 8 MHz tend to show the largest increase in performance. The original IBM PCs may not be able to wait as long between refreshes as ATs, but they will still show a noticeable speedup.

WHAT IF? Going beyond the limit of your system will almost always result in a "PARITY CHECK 1 00000(S)" or "PARITY CHECK 2 00000(S)" error. If

■ PC LAB NOTES

this occurs, you waited too long to refresh, the capacitors lost their charge, and the data just faded away. When this happened, one of the parity chips detected the change in value and signaled the alarm. This type of parity error isn't dangerous and can easily be cured—just turn off the PC, then turn it back on again.

The value stored in the parity chip is calculated every time the system reads or writes to the DRAM. (See the sidebar "Parity Checking.") The PC uses "even" parity. This means that for each byte of storage, the 8 bits of the byte plus the one parity bit assigned to that byte must equal an even number. Parity checking is a crude but effective way for the system to be fairly certain that all data stored in the DRAM is valid. IBM's reason for implementing parity checking was mainly to detect a hardware failure of a RAM chip. When extending the refresh cycle, the parity chip is our safety net and warns us when we have gone a little bit too far.

```
N QFRESH.COM          ;Name = QFRESH.COM
A 100                 ;Start Assembler
MOV AL,74             ;Select Timer #1 for a 16 Bit
OUT 43,AL             ; Number and to count down in binary
MOV AL,LL             ;Insert the low byte value
OUT 41,AL
MOV AL,HH             ;Insert the high byte value
OUT 41,AL
INT 20                ;Exit to DOS
                      ;Stop Assembler's Auto line numbering
R CX                  ;Call CX register
E                     ;Tell how many bytes to write to disk
W                     ;Write the file
Q                     ;Quit DEBUG and exit to a DOS Prompt
```

Figure 3: *The DEBUG script file for QFRESH.COM allows you to experiment with alternative refresh values. See the text for an explanation of the parameters.*

THE QFRESH PROGRAM To experiment with the refresh rate on your machine, you'll need a text editor that can produce pure ASCII files to create the DEBUG script shown in Figure 3. Saving the listing as an ASCII text file will allow us to experiment with various values, without retyping the program each time. (If you

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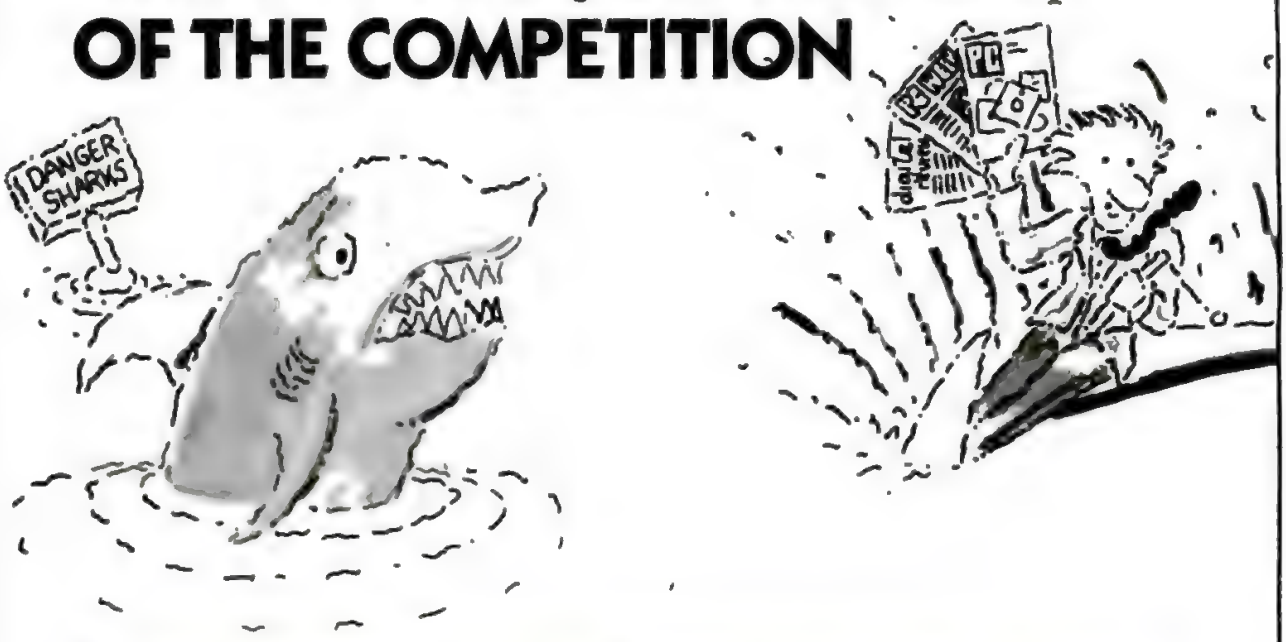

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System requirements: 100 percent IBM PC compatibility, 128K RAM and DOS 2.0 or greater. IBM is a trademark of International Business Machines. SideKick, Borland International.

CIRCLE 319 ON READER SERVICE CARD

It automates: now you can keep your PC working, even when you're not.

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■ PC LAB NOTES

feel comfortable working with DEBUG, you can enter the statements directly.)

If you examine the DEBUG script, you'll see that its first line loads the AL register with 74h. When this value is output to I/O port 43h, it tells the 8253 Mode Control Register to select Timer 1 and to expect a 16-bit number. The refresh timer is now ready for us to program in a new refresh interval. The number is a 16-bit value, but it must be divided into a low byte and a high byte because the I/O register can only accept one 8-bit number at a time.

In the script, there are two labels shown as *LL* and *HH*. These labels represent the low and high byte of the 16-bit number destined for port 41h. *Don't type these labels as shown!* Instead, replace them with the hex numbers that represent the new refresh value. Start out by entering 30 where you see *LL* and 00 where you see *HH*.

Except for the two refresh value labels, type in everything exactly as shown in Figure 3. Be sure to press the Enter key at the end of each line, especially the last one, and to leave a blank line just above the RCX. There is no need to type in the semicolons or the remarks that follow them.

■ You can use the tests in the PC Labs Benchmark Series (available on PC MagNet) to gauge the level of performance gained from QFRESH.

The program should be saved on your disk as an ASCII text file called QFRESH.SCR. Next, make sure DEBUG is in your current directory or in a directory listed in your PATH statement. Then create QFRESH.COM by entering the following command:

```
DEBUG < QFRESH.SCR
```

If you get no error messages, execute the program by entering the command

```
QFRESH
```

A refresh value of *LL*=30 won't cause a parity error on most PCs. You should also notice an increase in performance. Running almost any program will exercise the DRAM enough to cause any potential parity errors to surface. You can use the tests in the PC Labs Benchmark Series (available on PC MagNet) or another performance benchmark program to gauge the level of performance gained. Test programs, which calculate and display CPU speed in megahertz, will probably show a

PARITY CHECKING

In all the members of the IBM PC family (including clone cousins), a row of memory is made up of nine chips. Since memory is allocated in 8-bit bytes, you may wonder what the extra bit in the extra chip is for. That 9th bit is called the *parity* bit, and the data stored in that bit alerts us if an unauthorized change in the RAM occurs.

The bits in the parity chip are controlled by what is called the "74ALS280 Odd/Even Parity Generator/Checker." When a byte is written to memory, by loading a program or performing a calculation, for example, this chip determines whether the total of the bits in the byte is even or odd. If the result is odd, a 1 is stored in the parity bit. If the result is even, a 0 is stored. Because the PC stores the one-digit sum of the byte, the total of all 9 bits will always be even. This condition is known as *even parity*.

Whenever a byte is read, the Parity Generator/Checker recalculates the parity and compares it with the result previously stored in the parity chip's bit. If the two don't match, the dreaded Non-Maskable Interrupt (NMI) is generated and you get a Parity Check Error message on the screen. This process is illustrated in Figure A. When this happens, you have little choice but to turn the machine off until the problem can be corrected.

Parity errors can be caused by various events. The most common cause by far is a machine language program that runs berserk and generates a spurious NMI. In most cases this won't actually corrupt any memory, but the CPU will nonetheless interpret the NMI error as being real. On the other hand, when one or more bits within a RAM chip or supporting circuitry fail, the NMI error is real and has the effect of preventing any further use of the machine.

Parity checking is a very simple form of error detection. It was probably IBM's intention, when designing the PC, to include both parity detection and *correction* facilities to convince distrustful mainframe managers to accept the PC as a viable machine. This would have been nothing new to them. In fact, they had been accustomed to error detection and correction for years. But including a more involved procedure to be able to *correct* certain errors instead of merely reporting the fact would have been much more costly and, thus, lost out in the PC design.

There are quite a few methods for performing error correction. Most are based on fairly complex algorithms, although custom chips are available that will do it automatically. Unfortunately, the methods require more RAM to store the needed extra information.

In retrospect, it is understandable why IBM chose not to include error correction on PCs. The PC was not conceived as a serious business machine, and so no one thought it would ever need more than 640K. Today's "next-generation" PCs (PSs?) will need 3MB of memory just to get OS/2 up and flying. With all that operating system just sitting and waiting in RAM, ready to be corrupted, I think it will be none too soon before error correction becomes mandatory.

—Brian K. Roemmele

reading higher by 0.5 to 2 MHz. Obviously, the CPU's speed hasn't actually changed. Rather, such benchmarks determine the CPU speed by performing a series of calculations. Because the new refresh allows the PC to calculate faster, the benchmark believes your CPU clock speed has increased.

LIVING ON THE EDGE We started out with a relatively safe, low value for *LL*. The larger the *LL* value, the longer the PC will wait between refreshes. With this in mind, you can begin to try new values for *LL*. Try incrementing in steps of 10 or 20. Remember that *LL* is a hex number, and the maximum value is FF. Don't, however, use the value 00. This will produce *no* refresh cycle and a guaranteed parity error.

To experiment with different values, edit the QFRESH.SCR file and change the values of the *LL* and *HH*. Save the program as QFRESH.SCR and assemble again through DEBUG. Once you reach *LL*=FF, keep that value constant and start to increase *HH*. Begin with the *HH*=01 and work your way up.

■ The new refresh allows the PC to calculate faster, making the benchmark believe your CPU clock speed has increased, though it actually hasn't.

At each increment level, run the PC Labs Benchmark Tests and take note of the changes in the readings. At some point there will be no increase in performance, even though you may be a long way from reaching FF. This occurs when the refresh overhead has been decreased by such a large amount that any additional change doesn't produce a noticeable increase in speed. In some cases, *disk* performance will decrease substantially if you go too far beyond your system's optimal setting. Once you find you can increase the value without realizing any further return in performance, go back to the lowest number that created the highest performance. As one final test of your optimum values, leave your PC turned on but inactive for an extended period, say, overnight.

To make your performance increase automatic, enter your system's optimal values permanently in the *LL* and *HH* locations in the QFRESH.SCR file. Once again, use DEBUG to create the .COM file. You can run the final version of QFRESH by entering the name at the DOS

Parity Checking in the PC

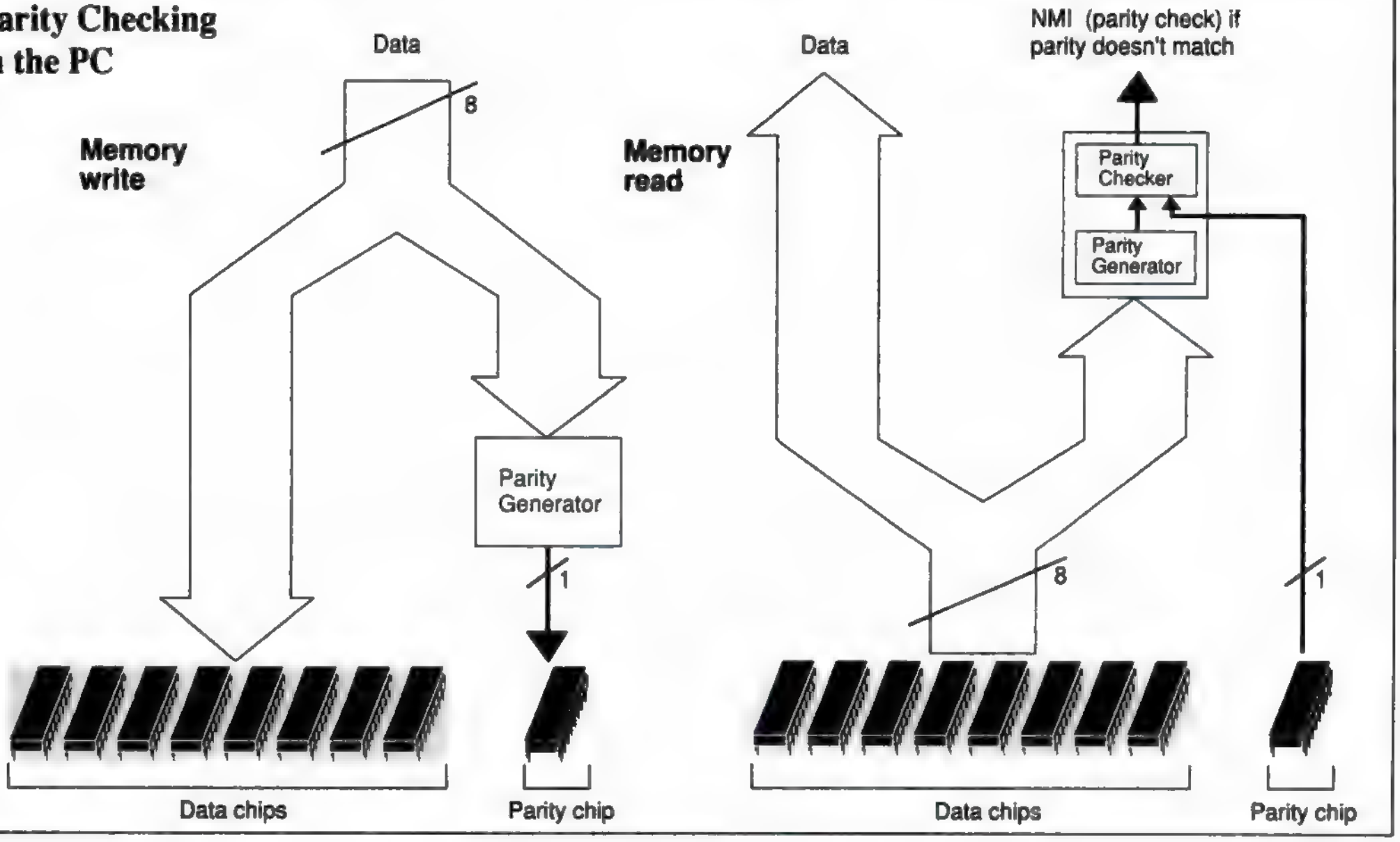
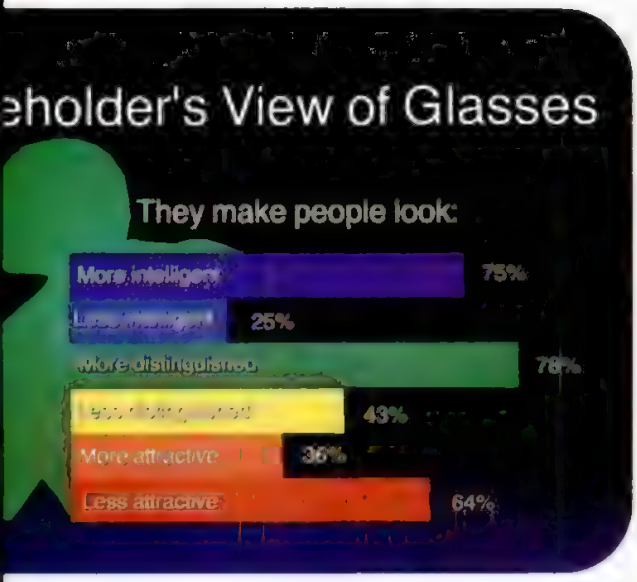
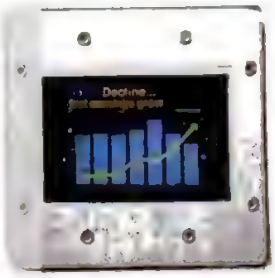
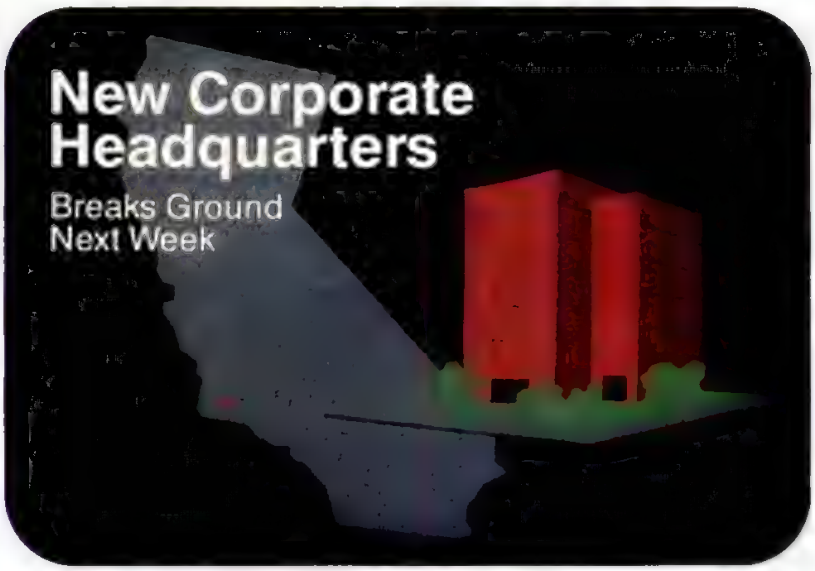


Figure A: *Each time a byte of data is written or read, the Parity Generator/Checker monitors the process.*

The state-of-the-







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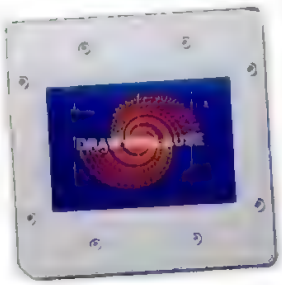

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CIRCLE 324 ON READER SERVICE CARD

■ PC LAB NOTES

prompt or by including it as the last item in your AUTOEXEC.BAT file. And before you trust anything, *be sure to give a trial run to all of your applications* to be sure everything is working as expected.

SLOW IT DOWN What refresh giveth, refresh also taketh away. If you need to *decrease* your system performance, you can put in 00 for *HH* and a value for *LL* in the 01h–11h range into the QFRESH.SCR file. Create QFRESH.COM and rename it SLOWDOWN.COM. Because these values increase the number of refresh cycles, they reduce performance by about 5 to 15 percent. Why would you want to slow down your machine? Well, I can recall at least one occasion when I have saved myself from total insanity. I had a system that kept locking up with intermittent parity errors. The RAM was beginning to go south, but it still had *some* retention left. So I loaded a 01h in the low byte of Timer 1, which decreased the time between refreshes. That made the parity errors disappear long enough for me to finish my project.

■ Before you run QFRESH, be sure to give a trial run to all of your applications to be sure everything is working as expected.

COMPATIBILITY I've tested about 200 of the most popular software packages and have yet to find any incompatibilities. The software usually interprets the new refresh cycle simply as a faster CPU speed. With DOS systems reaching speeds of 25 MHz, most software authors are getting into the habit of not assuming CPU speed. On the hardware side, as I mentioned before, the RAM chips can make a difference. In most cases better quality means better results. All of the expansion cards that I have tested checked out fine with the new refresh. The list ranged from the standard assortment of memory and video cards to exotic zero-wait-state memory boards and network controller cards. I hope you find QFRESH as useful as I have and squeeze out every last drop of performance from your system.

Brian K. Roemmele is the president of Ariel Computer Corp.

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With all the software tools available, it is surprising that an important need has been overlooked—a way to deal with the countless bits of RANDOM information you spend hours with every day. Tornado will not only give you instant access to this important information ... it will help you make better decisions and even think more clearly. Try Tornado risk-free and discover the productivity software package for your PC that works wonders.

■ Information Windows

With Tornado, you process information in stacks of superfast "intelligent" windows -several on your screen at once. You type into the windows; interconnect and prioritize them; and scan through them in remarkable ways.

■ Free Form

Tornado is FREE-FORM. It works the way you think. To start a new window you just press N, and enter information. No file names. No extra keystrokes. To retrieve information you just press G (for Get), with any word or phrase—you'll watch Tornado zip through your windows like lightning linking and opening those requested. You can even flip through your windows with the arrow keys and watch them instantly pile up and lift away. These are just three of 18 easy but powerful features.

■ Countless Uses

There are thousands of uses for Tornado. When Harry calls you on the phone, in two seconds flat you'll display the six windows on Harry before he finishes his first sentence! No more embarrassing pauses or scrambling for information. Tornado is so versatile you can: write and print a letter faster than ever; track things to do; edit electronic mail; and plan a project or event quickly and easily. You can even build a sophisticated "knowledge" base or an unstructured data base without programming. And that's not all. Track phone conversations, numbers, customers, and all your other RANDOM information. On a portable, Tornado is your ideal moving office. Best of all, you tailor Tornado to your own needs easily!

■ RANDOM Information

Did you ever realize that over half the information you deal with every day is the RANDOM type? Not databases not spreadsheets not long documents -but the information scattered around your workplace and in your head. Yet amazingly, until now there was no great software to help you the tools were either too structured or without organization. But now, at last, there is a quick and easy solution— Tornado acclaimed by rave reviews and accepted by corporations nationwide. Whether you are a business executive, consultant, engineer, or in any other profession, you need Tornado--it will save you endless time and effort every day --guaranteed -or your money back. Here is how it works:

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Instead of one window or ten, imagine up to 25,000! It's like extra memory...for your brain! The uses are endless. If you can "type" it you can "Tornado" it. And because it's memory resident (if you choose) you can quickly jump in from other programs—even move information between them. All this power, yet reviewers agree you can start "Tornado-ing" in 15 minutes—not 15 days.

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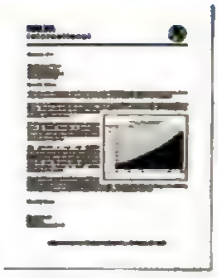

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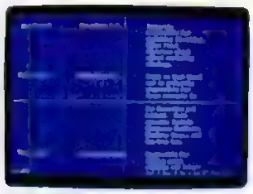
mances can be ing WordPerfect 5.0.

you create documents containing numerous type fonts and font sizes without having to change your margins, tabs or column definitions. You can also choose whatever typefaces your printer allows—from an assertive, extra-large times roman bold to an elegant, extra-fine italic—and 5.0 makes all the necessary spacing adjustments automatically as you go.



Parallel columns now extend past a page break automatically. And spacing can now be changed within a column.

If you're interested in a uniform look—in newsletters, for example—WordPerfect 5.0 has a new Style feature that lets you easily specify the format of your text. Styles are very flexible and can include size and font attributes, text, and other formatting specifications.

WordPerfect 5.0's improved Preview feature lets you see what your document will look like before you print.

And WordPerfect 5.0 offers many other sophisticated advances. Like an improved Preview that shows you what your document will look like before you print; letting you see actual font sizes, proportional spacing and justification. It also lets you zoom in on details, display an entire page of text and graphics at once, or view facing pages together.

There's also the new Master Document feature, which allows you to combine files. So if you're compiling portions of a major proposal or putting together chapters of a book, you can assemble a table of contents and an index, generate references and print the entire document easily.

Additions also include automatic referencing, automatic redline and strikeout, an alternative mnemonic interface, enhanced macro and macro editing capabilities, and improved parallel columns.

Check out all that the new WordPerfect 5.0 has to offer. It's the powerful performer from the company that's produced the number-one selling word processor for over two years running. For more information, write to WordPerfect Corporation, 1555 North Technology Way, Orem, Utah 84057. Or call (801) 225-5000. (In Canada, 1-800-267-2499.)

Typefaces can be mixed at will—up to 250 on a single page, depending on printer capabilities. And print sizes span a wide range.

WordPerfect® Document Processing

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CIRCLE 513 ON READER SERVICE CARD

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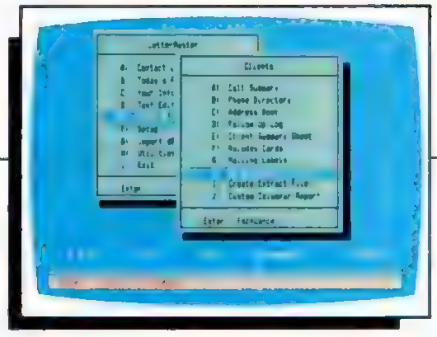
Client Management / Mail Management

4:30 **"Susan—Send our sales letter to all buyers of apples and cherries in Washington and oranges or bananas in Florida, in time for today's 5:00pm pick-up.—Mr. Werner."**

4:32 **Mailing lists sorted.**

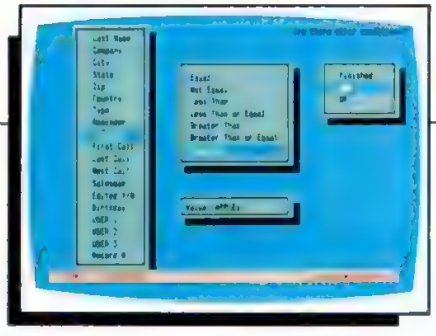


Our new LetterMaster mailing software is a lifesaver. It sorts any list according to any criteria in its own internal database and our dBASE® III files.

4:33 **Lists merged and purged.**

LetterMaster merges lists and purges duplications in a matter of seconds. It's incredible! I can create instant custom mailing lists with a few keystrokes!

4:38 **Personalized sales letters printed.**

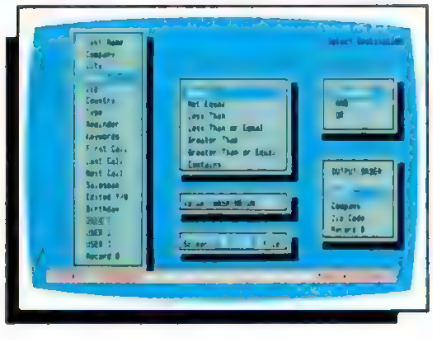


With LetterMaster, all I do is name the list, name the letter, activate the printer, and "go do." It's that simple!

4:41 **Labels printed.**

LetterMaster prints off any list onto leading brand address labels. It prints Rolodex cards and file folder labels, too.

4:45 **Mailing complete and ready for pick-up.**



LetterMaster operates with all the popular word processing programs. About the only thing it doesn't do is lick the envelopes!

System requirements for Single User: DOS 2.1 or higher, IBM PC or your IBM PS2, or 100% compatible. 512K RAM. System requirements for Network Work Station: DOS 3.1 or higher. 640K RAM, any combination of hard, floppy, or no disk drives. Trademark/Owners: LetterMaster/Dilg Properties, Inc., dBase III/Ashton-Tate Corp., IBM PC & IBM PS2/International Business Machines Corp., DOS/International Business Machines Corp. and Microsoft Corp.

CIRCLE 348 ON READER SERVICE CARD

5:00 **"Susan—Good work on that mailing.**

Have an apple.—Bob"

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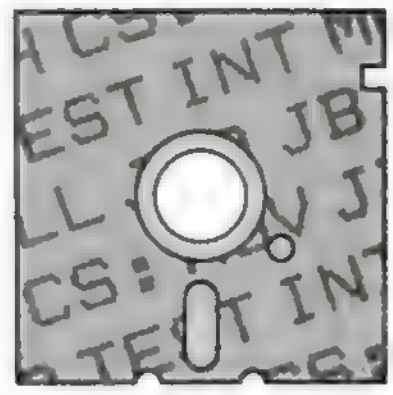
COMMUNICATIONS AND VIDEO SETUP WITH SETMODE



Configuring your PC through the MODE command is tedious and tricky. Here's a resident utility that makes setting your video mode and communications port parameters easy.

Most PC users leave the chore of setting up their machines to the ever-helpful Someone Else. Thanks to him, they never have to worry about such essential but unlovely details as data bits, stop bits, and video modes. But if Mr. Else ever gets sick and you have to configure anything but a plain-vanilla PC, you'll be glad you've got a program that gives you straightforward, comprehensible choices in place of the arcane syntax of the DOS MODE command.

SETMODE is a memory-resident utility program that gives you complete control over your communications ports and video modes. It provides the most-commonly-needed functions of the conventional MODE command and even provides access to information and features DOS ignores completely. Because it stays resident, you can make subsequent changes at a moment's notice. And since it's menu driven, setting up your system is simple.

The easiest way to get a copy of SETMODE.COM is to download it from PC MagNet, as explained in the sidebar "SETMODE by Modem." If you want to type in the code yourself, the source code (SETMODE.ASM) and a BASIC program (SETMODE.BAS) that will create SETMODE.COM are listed here and are also available via PC MagNet.

USING SETMODE As a resident program, SETMODE must be installed before it can be used. You can do this either by entering

```
SETMODE
```

at the DOS prompt or by entering that command as a line in your AUTOEXEC .BAT file. No parameters are needed. Once installed, you invoke SETMODE by pressing the Alt-M key combination. (A later section in this article will show you how to change the default Alt-M hotkey if you wish.) When you do, a window similar to that shown in Figure 1 will appear on your screen, indicating the current settings of the communications ports and the current video mode. A moving-bar-style cursor will also appear (initially located on the video mode selector), showing the active field.

You use the Plus, Minus, and arrow keys to make any changes desired, and when you hit Enter, the window disappears and the new video mode becomes effective. The display is cleared and the cursor is moved to the top left corner. Because SETMODE does not work through DOS, however, the prompt that was originally on your screen won't be replaced and you'll find yourself staring at a blank screen. Don't be alarmed. Just press Enter once again, and your friendly DOS prompt will reappear. (If you're running a program when you pop up SETMODE, you'll have to perform some program function that up-

Figure 1: *A single keystroke brings up this menu, which lets you configure your system with a simple moving bar.*

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dates the screen. It's a good general practice, however, to make mode changes only at the DOS prompt.)

If you press Esc, the window is removed but the video mode will remain unchanged. Any new communications port settings you've made on the screen menu will still go into effect just as if you had hit Enter.

Unlike many pop-up utilities, SETMODE is equally at home in graphics or in text modes. It does need to make slight adjustments, however. You'll notice its normal double-line border is replaced with a row of asterisks when you change into a graphics mode. This is because not all display adapters have the necessary screen fonts for the line characters in graphics modes. The display may also appear in different colors, depending on what type of adapter and display you're using. You'll also notice that the moving bar won't be visible in the three monochrome graphics modes (6, 15, and 17). When in these modes, you'll simply have to look at the numerical display indicator in the lower window to select a mode, moving from one to the other with the Left or Right Arrow key. Remember that the mode you select won't become obvious until you press Enter twice: once to effect the command, and again to return your DOS prompt.

VIDEO MODES Which modes are available depends on what adapter(s) and monitor(s) are installed in your system. If you've got a modest system with only a monochrome adapter and display, you'll have to be content with mode 7. With one of IBM's proud new VGA displays, you can pick from any of 15 available modes. A table of the modes supported by other adapters is shown in Figure 2. SETMODE automatically determines which modes are available for you and restricts your selections to the valid modes. (If you're wondering what happened to modes 8 through 12, they're reserved for the PC*jr* and for performing several internal EGA functions.)

The most common modes are 3 for color text and 7 for monochrome text. Most programs can run only in these modes. If you inadvertently switch to one of the graphics modes and then run a text-oriented program (such as a word processor), don't be surprised if your display switches back to a text mode. Well-written software that can't operate in graphics wisely adjusts the display during its initialization. If a program skips this vital step, it will likely display garbage on the screen.

If your system has more than one display card installed, SETMODE can switch the active adapter for you. The monochrome display can use modes 7 and 15. All other modes require a color monitor.

When browsing through the available video modes, you'll be able to see the available resolution with each mode in the window. For text modes, this is the number of rows and columns (some EGAs can display more than the nominal number of characters). For graphics modes, the number of picture elements (pixels) is given. The initial mode is indicated by an arrow at the bottom of the lower window. If you don't want to disturb the display, be sure to return to this mode before pressing Enter. Remember that when the mode is changed, the screen will be cleared.

To harness the full capability of your EGA or VGA display system, you'll want to combine SETMODE with a color program such as SPECTRUM (see PC Lab Notes, June 23, 1987). With this duo, you'll have the power you need to experiment with more color options than DOS ever expected.

One limitation of SETMODE will become apparent when the program is activated in a graphics mode. Although the original text is restored, any graphics (such as a pie chart or picture) are lost. SETMODE can save only the underlying character data. In fact, you'll notice further that the text is always restored in black and white. Although it would be theoretically possible to correct this problem, the wide variety of graphics modes would have made the resulting code extremely complex. Further, a very large amount of memory would have been required to save graphics images, and it's important for resident programs to use as little memory as possible. Character data is always preserved, however, even in graphics mode.

THE SERIAL PORTS In addition to switching video modes, the communication port protocol can be initialized or changed with SETMODE. When the pro-

Video Adapters and Supported Modes

Mode		VGA	MCGA	EGA (color monitor)	EGA (mono monitor)	CGA	MDA
0	text	●	●	●	○	●	○
1	text	●	●	●	○	●	○
2	text	●	●	●	○	●	○
3	text	●	●	●	○	●	○
4	graphics	●	●	●	○	●	○
5	graphics	●	●	●	○	●	○
6	graphics	●	●	●	○	●	○
7	text	●	○	○	●	○	●
13	graphics	●	○	●	○	○	○
14	graphics	●	○	●	○	○	○
15	graphics	●	○	○	●	○	○
16	graphics	●	○	●	○	○	○
17	graphics	●	●	○	○	○	○
18	graphics	●	○	○	○	○	○
19	graphics	●	●	○	○	○	○

●—Yes ○—No

Figure 2: *Not all video modes are available with every display adapter. Here are the combinations that will work.*

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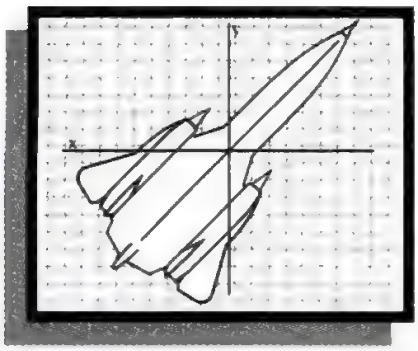

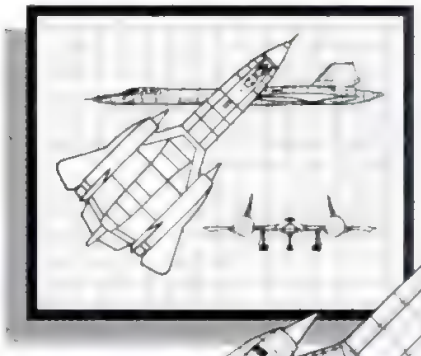

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```
;                                 ************************************
; SETMODE is a resident program which allows you to set the video mode
; and the communication port protocol.  PC Magazine July, 1988
;-----------------------------------------------------------------------
; BIOS_SEG is the ROM-BIOS data area
;-----------------------------------------------------------------------
BIOS_SEG        SEGMENT AT 0040H
                ORG     0010H
EQUIP_FLAG      DW      ?
                ORG     0049H
CRT_MODE        DB      ?
COLUMNS         DB      ?               ;Current number of columns
                ORG     0050H
CURSOR_POSN     DW      8 DUP(?)        ;Current cursor location
                ORG     0062H
ACTIVE_PAGE     DB      ?               ;Active page for CGA and EGA
                ORG     0084H
ROWS            DB      ?               ;Last row number for EGA
                DW      ?
EGA_INFO        DB      ?
BIOS_SEG        ENDS

CSEG            SEGMENT
                ASSUME  CS:CSEG, DS:CSEG, ES:CSEG
                ORG     0100H           ;Beginning for .COM programs
START:          JMP     INITIALIZE      ;Initialization code is at end

;-----------------------------------------------------------------------
; Data area used by this program
;-----------------------------------------------------------------------
HOTKEY          EQU     32H             ;Scan code for "M" key
SHIFT_MASK      EQU     00001000B       ;Mask for ALT key
CR              EQU     13
LF              EQU     10

COPYRIGHT       DB      "SETMODE 1.0 (c) 1988 Ziff Communications Co."
                DB      CR,LF,"PC Magazine ",254," Tom Kihlken"
                DB      CR,LF,"Hotkey is Alt-M$",1AH
INSTALLED_MSG   DB      CR,LF,"Already Installed$"

WINDOW_TEXT     DB      2, 1,"SETMODE 1.0    "
                DB      24,32,25,32,26,32,27," + -  <CR> Esc",0
                DB      4, 4,"COMMUNICATION PORTS",0
                DB      2, 5,"Port:",0
                DB      16,5,"1",0
                DB      23,5,"2",0
                DB      30,5,"3",0
                DB      37,5,"4",0
                DB      2, 6,"Bps:",0
                DB      2, 7,"Parity:",0
                DB      2, 8,"Data bits:",0
                DB      2, 9,"Stop Bits:",0
                DB      2,10,"DSR:",0
                DB      4,13,"DISPLAY",0
                DB      4,14,"Mode:",0
                DB      2,15,"0 1 2 3 4 5 6 7 13 14 15 16 17 18 19",0,0

COUNTER1        DB      ?
COUNTER2        DB      ?
BUSY_FLAG       DB      0
COLORS          LABEL   WORD
NORMAL          DB      ?
INVERSE         DB      ?
OLDINT09        DD      ?
LEFT_SIDE       DB      ?
MODE_SELECT     DB      ?
GRAPH_TEXT      DB      ?
ITEM_SELECT     DB      0
PORT_SELECT     DB      0
PORT_ADDRESS    DW      ?
ADAPTER_FLAGS   DB      ?
ADAPTER_TABLE   DB      54,54,54,54,54,54,54,25,00,00,00,00,00,20,20
                DB      24,20,48,16,48
EQUIP_TABLE     DB      16,16,32,32,32,32,32,48,00,00,00,00,00,16,16
                DB      48,16,32,32,32

;-----------------------------------------------------------------------
; This is the main routine of the resident portion of the code
;-----------------------------------------------------------------------
SETMODE         PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                CALL    GET_CURS_ADDR   ;Cursor address for this page
                PUSH    ES:[BX]         ;Save the cursor location
                MOV     AL,ES:CRT_MODE  ;Get current mode
                AND     AL,01111111B    ;Mask the high bit
                MOV     MODE_SELECT,AL  ;Store the initial video mode

                MOV     GRAPH_TEXT,1
                MOV     BX,7007H        ;Colors for mono mode
                CMP     AL,07H          ;In mono text mode?
                JE      NOT_COLOR_TEXT
                MOV     BX,0503H        ;Colors for graphics modes
                MOV     GRAPH_TEXT,0
                CMP     AL,3            ;In CGA text mode?
                JA      NOT_COLOR_TEXT
                MOV     GRAPH_TEXT,1
                MOV     BH,ES:ACTIVE_PAGE
                MOV     AH,8            ;Read current colors
                INT     10H             ;BIOS read char/attribute
                MOV     BL,AH           ;Foreground color
                MOV     BH,AH           ;Background color
                XOR     BH,11110111B    ;Flip the color bits
NOT_COLOR_TEXT:
                MOV     COLORS,BX
                MOV     DI,OFFSET WINDOW_BUFFER
                MOV     DL,ES:COLUMNS   ;Compute center of screen
                SUB     DL,40           ;We'll use 40 columns
                SHR     DL,1            ;Divide by two
                MOV     LEFT_SIDE,DL    ;This is column for left edge

                XOR     DH,DH           ;First window in row 0
                MOV     COUNTER1,1
                CALL    OPEN_WINDOW     ;Open top window
                MOV     COUNTER1,6
                CALL    OPEN_WINDOW     ;Open middle window
                MOV     COUNTER1,3
                CALL    OPEN_WINDOW     ;Open bottom window
                MOV     SI,OFFSET WINDOW_TEXT
TEXT_LOOP:
                LODSW                   ;Fill in window text
                OR      AL,AL
                JZ      TEXT_DONE       ;Is this the last string yet?
                MOV     DX,AX           ;Get row/column for this string
                ADD     DL,LEFT_SIDE    ;Add in left edge of window
                CALL    TTY_STRING      ;Put up the string
                JMP     TEXT_LOOP       ;Loop for all text strings
TEXT_DONE:
                CMP     ES:CRT_MODE,19  ;Is this mode 0-19?
                JA      GET_A_KEY       ;If not, can't point to it
                CALL    VIDEO_COLUMN    ;Get column for current mode
                INC     DL
                MOV     DH,16
                MOV     AL,30           ;ASCII for up carrot
                CALL    DISPLAY_NORMAL  ;Pointer to current mode
GET_A_KEY:
                CALL    SHOW_PORTS      ;Display comm port status
                CALL    SHOW_MODE       ;Display video info
                MOV     CH,INVERSE
                CALL    REV_BAR         ;Inverse video for selected item
                XOR     AH,AH
                INT     16H             ;Read a keystroke
                PUSH    AX              ;Save the keystroke
                MOV     CH,NORMAL
                CALL    REV_BAR         ;Turn off reverse bar
                POP     AX              ;Get back the keystroke

                CMP     AH,48H          ;Is it up arrow ?
                JNE     NOT_UP
                CMP     WORD PTR ES:[0088],0 ;Is there a COMM1?
                JZ      GET_A_KEY       ;If not, don't go up
                DEC     ITEM_SELECT     ;Move up to next item
                JNS     GET_A_KEY
                MOV     ITEM_SELECT,4
                JMP     GET_A_KEY       ;And get another keystroke
NOT_UP:
                CMP     AH,50H          ;Is it down arrow?
                JNE     NOT_DOWN
                INC     ITEM_SELECT     ;Move down to next item
                CMP     ITEM_SELECT,4
                JBE     GET_A_KEY
                MOV     ITEM_SELECT,0
                JMP     GET_A_KEY
NOT_DOWN:
                CMP     AH,4DH          ;Is it right arrow?
                JNE     NOT_RIGHT
                MOV     AL,1            ;Indicate moving to right
                CALL    SIDEWAYS        ;And move the bar
NOT_RIGHT:
                CMP     AH,4BH          ;Is it left arrow?
                JNE     NOT_LEFT
                MOV     AL,-1           ;Indicate moving to left
                CALL    SIDEWAYS        ;And move the bar
NOT_LEFT:
                CMP     AL,"+"          ;Is it the plus key?
                JNE     NOT_PLUS
                MOV     CL,1            ;Indicate increasing value
                JMP     CHG_COMM
NOT_PLUS:
                CMP     AL,"-"          ;Is it the minus key?
                JNE     NOT_MINUS
                MOV     CL,-1           ;Indicate decrease value
                JMP     CHG_COMM
NOT_MINUS:
                CMP     AH,1            ;Is it escape?
                JE      ESC_OUT
                CMP     AL,13           ;Is it carriage return?
                JE      EXIT_OUT
                JMP     GET_A_KEY       ;Ignore any other keys
ESC_OUT:
                MOV     AL,ES:CRT_MODE  ;Get starting video mode
                MOV     MODE_SELECT,AL  ;Make it the selected mode
EXIT_OUT:
                XOR     DH,DH           ;Restore the window
                MOV     SI,OFFSET WINDOW_BUFFER
ROW_LOOP:
                MOV     CX,40           ;Do all 40 columns
                MOV     DL,LEFT_SIDE
COL_LOOP:
                LODSW
                CALL    DISPLAY_CHAR
                LOOP    COL_LOOP        ;Loop for each column
                INC     DH              ;Move to next row
                CMP     DH,18
                JNE     ROW_LOOP        ;Loop for each row
                CALL    GET_CURS_ADDR   ;Get cursor address for this page
                POP     ES:[BX]         ;Restore original cursor position

                MOV     BL,MODE_SELECT  ;Get starting video mode
                CMP     BL,ES:CRT_MODE  ;Has it changed?
                JE      SAME_MODE       ;If not, just return
                XOR     BH,BH
                MOV     CL,EQUIP_TABLE[BX]
                MOV     AX,ES:EQUIP_FLAG
                AND     AL,11001111B    ;Erase old video settings
                OR      AL,CL           ;Set new video equipment bits
                MOV     ES:EQUIP_FLAG,AX;Write new equipment word
                MOV     AX,BX
                INT     10H             ;Reinitialize video adapter
                MOV     AH,2
                XOR     DX,DX           ;Put cursor at home
                XOR     BH,BH           ;For page zero
                INT     10H             ;BIOS set cursor function
SAME_MODE:
                RET
SETMODE         ENDP
```

(continues)

SETMODE.ASM: *The assembly language source code for SETMODE.COM.*

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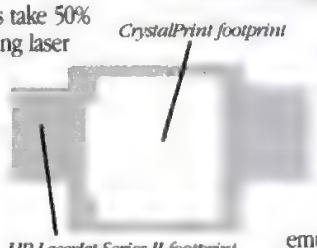

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;--------------------------------------------------------------------------
; Sideways moves the moving bar left and right
;--------------------------------------------------------------------------
SIDEWAYS        PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                CMP     ITEM_SELECT,0   ;Doing video modes?
                JE      CHG_MODE        ;If yes then change the mode
                MOV     BL,PORT_SELECT  ;Get comm port number
                ADD     BL,AL           ;Move to next port
                MOV     PORT_SELECT,BL
                CMP     BL,3            ;Maximum of 3 ports
                JA      SIDEWAYS

                XOR     BH,BH
                SHL     BX,1
                CMP     WORD PTR ES:[BX],0 ;Is there a card installed?
                JE      SIDEWAYS        ;If no card move to next
                RET
CHG_MODE:
                CMP     ADAPTER_FLAGS,0
                JE      UNKNOWN_ADAPTER
                MOV     BL,MODE_SELECT  ;Get current mode
                ADD     BL,AL           ;Move to next one
                MOV     MODE_SELECT,BL
                CMP     BL,19           ;Last mode is number 19
                JA      CHG_MODE
                XOR     BH,BH
                MOV     CL,ADAPTER_TABLE[BX]
                AND     CL,ADAPTER_FLAGS ;Is this adapter installed?
                JZ      CHG_MODE        ;If not, use next mode
UNKNOWN_ADAPTER:
                RET
SIDEWAYS        ENDP

;--------------------------------------------------------------------------
; CHG_COMM changes the parameters of the serial ports
;--------------------------------------------------------------------------
CHG_COMM        PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                MOV     BL,PORT_SELECT  ;Look at current port
                XOR     BH,BH
                SHL     BX,1
                MOV     DX,ES:[BX]      ;Get the card address
                ADD     DX,3            ;Point to line control
                MOV     AH,ITEM_SELECT
                DEC     AH              ;Changing baudrate?
                JZ      CHG_BAUD
                DEC     AH              ;Doing parity change?
                JZ      CHG_PARITY
                DEC     AH              ;Changing data bits
                JZ      CHG_DATA_BITS
                DEC     AH              ;Changing stop bits
                JZ      CHG_STOP_BITS
                JMP     GET_A_KEY
CHG_BAUD:
                CALL    READ_SET_BPS    ;Read current baudrate
                CMP     CL,1
                JNE     LOWER_BAUD      ;Going up?
                CMP     BX,3            ;At 38400 bps?
                JNE     SHIFT_DOWN
                INC     BX              ;This is to get 57600 bps
SHIFT_DOWN:
                SHR     BX,1            ;Divide by two for new rate
                OR      BX,BX           ;Is divisor zero yet?
                JNZ     SET_NEW_BAUD
                MOV     BX,384          ;Divisor for 300 bps
                JMP     SHORT SET_NEW_BAUD
LOWER_BAUD:
                SHL     BX,1            ;Times two for new rate
                CMP     BX,4            ;At 28800 bps?
                JNE     SHIFT_UP
                DEC     BX              ;This is to get 38400 bps
SHIFT_UP:
                CMP     BX,384          ;At 300 bps yet?
                JBE     SET_NEW_BAUD
                MOV     BX,1            ;Set divisor to 1
SET_NEW_BAUD:
                CALL    READ_SET_BPS    ;Set the new value
                JMP     GET_A_KEY       ;And get another keystroke
CHG_PARITY:
                IN      AL,DX           ;Get current parity bits
                MOV     BL,AL
                AND     AL,11000111B    ;Erase old parity bits
                SHR     BL,1            ;Shift parity bits over
                SHR     BL,1
                SHR     BL,1
CHG_AGAIN:
                ADD     BL,CL           ;Add in the change
                AND     BL,00000111B
                TEST    BL,00000001B
                JNZ     PARITY_OK
                TEST    BL,00000110B
                JNZ     CHG_AGAIN       ;Skip meaningless settings
PARITY_OK:
                SHL     BL,1            ;Move parity bits back left
                SHL     BL,1
                SHL     BL,1
                OR      AL,BL           ;Replace other starting bits
                JMP     SHORT CHG_COMM_RET
CHG_DATA_BITS:
                IN      AL,DX           ;Get line control register
                MOV     AH,AL           ;Save original line control
                AND     AH,11111100B    ;Mask out old data bits
                ADD     AL,CL
                AND     AL,00000011B    ;These are the new data bits
                OR      AL,AH           ;Put back other starting bits
                JMP     SHORT CHG_COMM_RET
CHG_STOP_BITS:
                IN      AL,DX           ;Get line control register
                XOR     AL,00000100B    ;Toggle the stop bit flag
CHG_COMM_RET:
                OUT     DX,AL           ;Set new line status
                JMP     GET_A_KEY
CHG_COMM        ENDP

;--------------------------------------------------------------------------
; REV_BAR turns the moving bar off and on
;--------------------------------------------------------------------------
BAR_SIZE        DB      8,6,5,1,1
```

```
REV_BAR         PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                MOV     DH,ITEM_SELECT  ;Get selected item
                OR      DH,DH           ;Are we in video mode row?
                JZ      DOING_VIDEO     ;If yes then use video bar

                MOV     BL,DH           ;BL has item number
                XOR     BH,BH
                MOV     CL,BAR_SIZE[BX] ;Get size of this bar
                ADD     DH,5
                MOV     AL,7
                MUL     PORT_SELECT
                ADD     AL,17
                SUB     AL,CL
                ADD     AL,LEFT_SIDE
                MOV     DL,AL
REV_LOOP:
                CALL    READ_CHAR       ;Read current char at this position
                MOV     AH,CH           ;Change the attribute
                CALL    DISPLAY_CHAR    ;Then write the character again
                DEC     CL
                JNZ     REV_LOOP
DONT_SHOW_IT:
                RET
DOING_VIDEO:
                CMP     MODE_SELECT,19  ;Is this mode in normal range
                JA      DONT_SHOW_IT    ;If not, just skip it
                CALL    VIDEO_COLUMN    ;Find column for this mode
                MOV     DH,15           ;Video is on row 15
                MOV     CL,2            ;Size of bar is two columns
                JMP     REV_LOOP
REV_BAR         ENDP

;--------------------------------------------------------------------------
; VIDEO_COLUMN returns the column position for the selected video mode
;--------------------------------------------------------------------------
COLUMN_DATA     DB      1,3,5,7,9,11,13,15,0,0,0,0,0,18,21,24,27,30,33,36
VIDEO_COLUMN    PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                MOV     BL,MODE_SELECT  ;Get selected mode
                XOR     BH,BH
                MOV     DL,COLUMN_DATA[BX]
                ADD     DL,LEFT_SIDE    ;Add in column of left side
                RET
VIDEO_COLUMN    ENDP

;--------------------------------------------------------------------------
; OPEN_WINDOW draws a box with the double line border
;--------------------------------------------------------------------------
OPEN_WINDOW     PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:NOTHING
                OR      DH,DH
                JZ      TOP_LINE
                MOV     AL," "
                MOV     CX," "*256+" "
                CALL    OPEN_LINE       ;Open a blank line
TOP_LINE:
                MOV     AL,201
                MOV     CX,187*256+205
                CALL    OPEN_LINE       ;Top line
WIN_LOOP2:
                MOV     AL,186
                MOV     CX,186*256+" "
                CALL    OPEN_LINE       ;Middle lines
                DEC     COUNTER1
                JNZ     WIN_LOOP2
                MOV     AL,200
                MOV     CX,188*256+205
                CALL    OPEN_LINE       ;Bottom line
                RET
OPEN_WINDOW     ENDP

;--------------------------------------------------------------------------
; OPEN_LINE is used by OPEN_WINDOW to create one row of the window
;--------------------------------------------------------------------------
OPEN_LINE       PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                MOV     DL,LEFT_SIDE
                CALL    SAVE_CHAR
                MOV     COUNTER2,38
MIDDLE_LOOP:
                MOV     AL,CL
                CALL    SAVE_CHAR
                DEC     COUNTER2
                JNZ     MIDDLE_LOOP
                MOV     AL,CH
                CALL    SAVE_CHAR
                INC     DH
                RET
OPEN_LINE       ENDP

;--------------------------------------------------------------------------
; SAVE_CHAR stores a character from the screen and displays a new char
;--------------------------------------------------------------------------
SAVE_CHAR       PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                PUSH    AX              ;Save the new character
                CALL    READ_CHAR       ;Read the existing character
                CMP     GRAPH_TEXT,1
                JE      MODE_TEXT1
                MOV     AH,NORMAL       ;Use normal foreground color
MODE_TEXT1:
                MOV     DS:[DI],AX      ;And store it in the buffer
                INC     DI
                INC     DI
                POP     AX              ;Get back new character
                CMP     GRAPH_TEXT,1
                JE      MODE_TEXT2
                TEST    AL,10000000B    ;Is this a high bit character
                JZ      MODE_TEXT2      ;If not, just continue
                MOV     AL,"?"          ;If it is, reset it to "?"
MODE_TEXT2:
                CALL    DISPLAY_NORMAL  ;Put up the new character
                RET
SAVE_CHAR       ENDP
```

(SETMODE.ASM continues)

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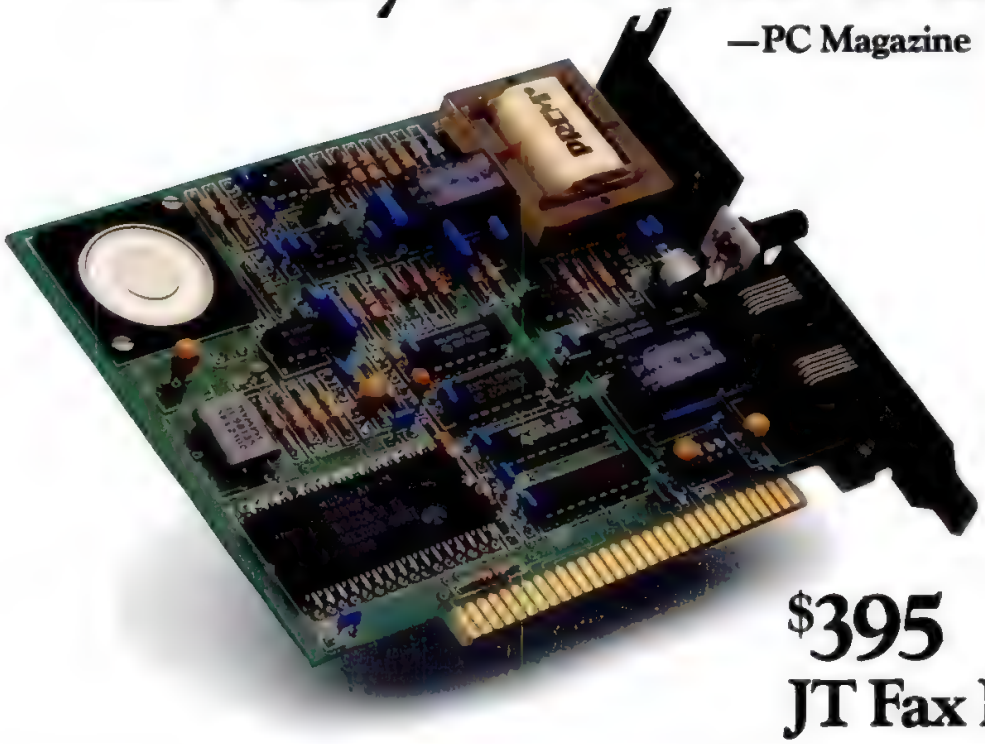

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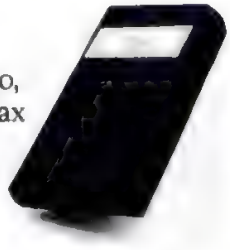

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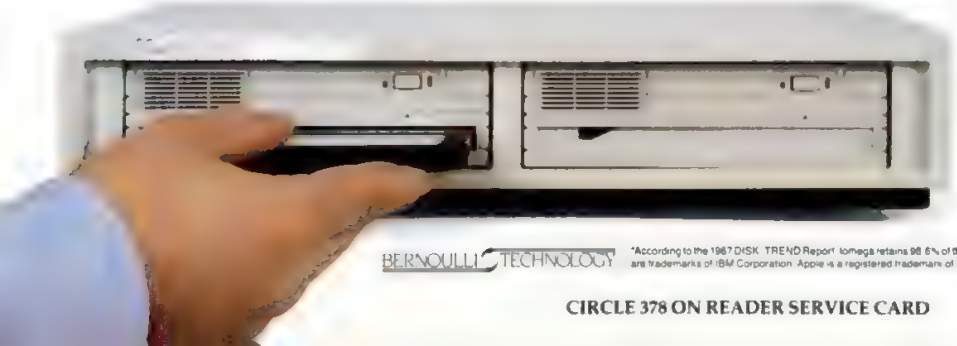

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■ UTILITIES

```
;-----------------------------------------------------------------
; TTY_STRING displays an ASCII string terminated with a byte of zero
;-----------------------------------------------------------------
TTY_STRING      PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                LODSB
                OR      AL,AL
                JZ      TTY_RET
                CALL    DISPLAY_NORMAL
                JMP     TTY_STRING
TTY_RET:
                RET
TTY_STRING      ENDP

;-----------------------------------------------------------------
; DISPLAY_NORMAL uses BIOS to display a character using a BIOS function call
;-----------------------------------------------------------------
DISPLAY_NORMAL  PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                MOV     AH,NORMAL
DISPLAY_CHAR:
                PUSH    BX
                PUSH    CX
                CALL    GET_CURS_ADDR   ;Get address of BIOS cursor
                MOV     ES: [BX],DX     ;Tell BIOS where the cursor is
                MOV     BL,AH           ;Get back the attribute
                MOV     BH,ES:ACTIVE_PAGE ;Get active page
                MOV     CX,1            ;Write 1 character
                MOV     AH,9            ;Write character and attribute
                INT     10H
                POP     CX
                POP     BX
                INC     DL              ;Advance the cursor column
                RET                     ;Done writing the character
DISPLAY_NORMAL  ENDP

;-----------------------------------------------------------------
; READ_CHAR reads a character from the screen
;-----------------------------------------------------------------
READ_CHAR       PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                CALL    GET_CURS_ADDR   ;Get address of BIOS cursor
                MOV     ES: [BX],DX     ;Tell BIOS where the cursor is
                MOV     BH,ES:ACTIVE_PAGE ;Get active page
                MOV     AH,8            ;BIOS function to read character
                INT     10H             ;Read the character/attribute
                RET
READ_CHAR       ENDP

;-----------------------------------------------------------------
; GET_CURS_ADDR finds the address of the cursor for current video page
;-----------------------------------------------------------------
GET_CURS_ADDR   PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                MOV     BL,ES:ACTIVE_PAGE ;Get the current page number
                XOR     BH,BH           ;Convert to a word offset
                SHL     BX,1            ;Times two for a word
                ADD     BX,OFFSET CURSOR_POSN ;Add in base address
                RET
GET_CURS_ADDR   ENDP

;-----------------------------------------------------------------
YES_TXT         DB      "Yes",0
NO_TXT          DB      " No",0
NA_TXT          DB      "n/a",0
NONE_TXT        DB      " None",0
ODD_TXT         DB      "  Odd",0
EVEN_TXT        DB      " Even",0
SPACE_TXT       DB      "Space",0
MARK_TXT        DB      " Mark",0
PARITY_TABLE    DW      OFFSET ODD_TXT,   OFFSET EVEN_TXT
                DW      OFFSET SPACE_TXT, OFFSET MARK_TXT

;-----------------------------------------------------------------
; SHOW_PORTS displays the current settings of all comm ports
;-----------------------------------------------------------------
SHOW_PORTS      PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                XOR     BX,BX
                MOV     COUNTER1,BL     ;Start with first comm port
PORT_LOOP:
                MOV     AL,7            ;Seven columns per port column
                MUL     BL
                SHR     AL,1
                MOV     CX,6*256+16     ;Row/column for first item
                ADD     CL,LEFT_SIDE    ;Add in column of left edge
                ADD     CL,AL           ;And shift over to correct column

                MOV     DX,ES:[BX]      ;Retrive the comm port address
                MOV     BP,DX           ;And save it here
                OR      DX,DX           ;Is there a card installed?
                JNZ     GOT_CARD        ;If yes, display its status
                MOV     SI,OFFSET NA_TXT
                MOV     DX,CX           ;Get row/column for this entry
                SUB     DL,2
                CALL    TTY_STRING      ;Display "n/a" text
                JMP     NEXT_PORT       ;And go on to next port
GOT_CARD:
                MOV     AL,"0"          ;Put a zero in bps column
                MOV     DX,CX
                CALL    DISPLAY_NORMAL  ;Display the zero
                MOV     DX,BP
                ADD     DX,3            ;Point to line control register
                CALL    READ_SET_BPS    ;Read the current baud rate
                PUSH    BX              ;Save it
                CALL    READ_SET_BPS    ;Restore original baud settings
                POP     BX              ;Now we have the bps in BX
                OR      BX,BX           ;Is it set to zero?
                JZ      NO_BPS_SET      ;If yes, just skip it
                XOR     DX,DX
                MOV     AX,115200
                DIV     BX

                MOV     COUNTER2,6      ;Display five digits
                PUSH    CX
                MOV     SI,CX           ;Save cursor position
                MOV     BX,10
                MOV     CX,AX
                XOR     AX,AX
CHAR_LOOP:
                MOV     CX,DX
                XOR     DX,DX
                DIV     BX
                XCHG    AX,CX
                DIV     BX
                XCHG    AX,DX
                ADD     AL,"0"          ;Convert this digit to ASCII
                PUSH    DX
                DEC     SI              ;Backup cursor position
                MOV     DX,SI
                CALL    DISPLAY_NORMAL  ;Display this digit
                DEC     COUNTER2
                POP     DX
                MOV     AX,CX
                OR      CX,DX
                JNZ     CHAR_LOOP
                MOV     DX,SI
FILL_BLANKS:
                DEC     DL
                MOV     AL," "
                CALL    DISPLAY_NORMAL
                DEC     DL
                DEC     COUNTER2
                JNZ     FILL_BLANKS
                POP     CX
NO_BPS_SET:
                MOV     DX,BP           ;Get back the port address
                ADD     DX,3            ;Line control register
                IN      AL,DX
                PUSH    AX              ;Save starting status
                MOV     SI,OFFSET NONE_TXT
                TEST    AL,00001000B    ;Look at parity enable bit
                JZ      NO_PARITY
                AND     AX,00110000B    ;Look at parity bits
                SHR     AX,1
                SHR     AX,1
                SHR     AX,1
                MOV     SI,AX
                MOV     SI,PARITY_TABLE [SI]
NO_PARITY:
                MOV     DX,CX
                SUB     DL,4
                ADD     DH,1
                CALL    TTY_STRING      ;Display parity status

                POP     AX
                PUSH    AX              ;Get line control status again
                AND     AL,00000011B    ;Look at data bits
                ADD     AL,"5"          ;Convert it to ASCII code
                MOV     DX,CX
                ADD     DH,2
                CALL    DISPLAY_NORMAL

                POP     DX
                PUSH    DX              ;Get line control status again
                MOV     AL,"1"          ;Assume one stop bit
                TEST    DL,00000100B    ;Are two stop bits used?
                JZ      ONE_STOP
                INC     AL
ONE_STOP:
                MOV     DX,CX
                ADD     DH,3
                CALL    DISPLAY_NORMAL

                MOV     DX,BP
                ADD     DX,6            ;Point to modem status register
                IN      AL,DX
                MOV     SI,OFFSET NO_TXT
                TEST    AL,00100000B    ;Is bit five set?
                JZ      NO_DSR          ;If not, DSR is not on
                MOV     SI,OFFSET YES_TXT
NO_DSR:
                MOV     DX,CX
                ADD     DH,4
                SUB     DL,2
                CALL    TTY_STRING

                POP     AX
                MOV     DX,BP           ;Get back the card adress
                ADD     DX,3
                OUT     DX,AL           ;Restore the line status register
NEXT_PORT:
                MOV     BL,COUNTER1
                XOR     BH,BH
                INC     BX
                INC     BX
                CMP     BL,8            ;Do four comm ports
                JAE     PORT_DONE
                MOV     COUNTER1,BL
                JMP     PORT_LOOP
PORT_DONE:
                RET
SHOW_PORTS      ENDP

;-----------------------------------------------------------------
; READ_SET_BPS reads the current baud rate and sets a new one
;-----------------------------------------------------------------
READ_SET_BPS    PROC    NEAR
                ASSUME  CS:CSEG, DS:NOTHING, ES:NOTHING
                IN      AL,DX           ;Read the line status register
                MOV     AH,AL           ;Save initial line status
                MOV     AL,80H
                OUT     DX,AL
                SUB     DX,3            ;Get to low byte of divisor
                IN      AL,DX
                XCHG    BL,AL
                OUT     DX,AL           ;Write the high byte of divisor
                INC     DX              ;Get to high byte of divisor
                IN      AL,DX
                XCHG    BH,AL
                OUT     DX,AL           ;Write the high byte of divisor
                INC     DX              ;Back to line status register
                MOV     AL,AH           ;Get back original line status
                OUT     DX,AL           ;And restore it
                RET
```

(SETMODE.ASM continues)

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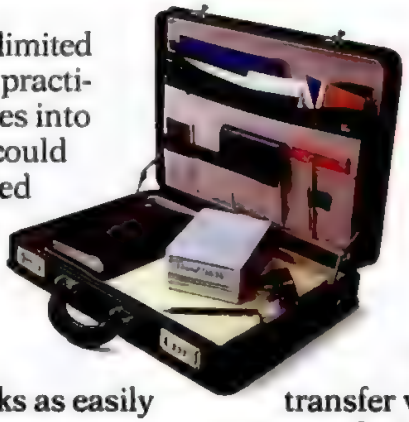

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CIRCLE 245 ON READER SERVICE CARD

■ UTILITIES

```
READ_SET_BPS    ENDP

;---------------------------------------------------------------------------
COLOR_TABLE     DB      1,2,1,2,2,1,1,3,2,2,3,2,1,2,2
RES_TABLE       DW      OFFSET RES_1, OFFSET RES_1, OFFSET RES_2
                DW      OFFSET RES_2, OFFSET RES_3, OFFSET RES_3
                DW      OFFSET RES_4, OFFSET RES_2, OFFSET RES_5
                DW      OFFSET RES_4, OFFSET RES_6, OFFSET RES_6
                DW      OFFSET RES_7, OFFSET RES_7, OFFSET RES_5
RES_1           DW      "25x40  ",0
RES_2           DB      "25x80  ",0
RES_3           DB      "320x200",0
RES_4           DB      "640x200",0
RES_5           DB      "320x200",0
RES_6           DB      "640x350",0
RES_7           DB      "640x480",0
TEXT_TXT        DB      "Text ",0
GRAPH_TXT       DB      "Graph",0
COLOR_TXT       DB      "Color",0
MONO_TXT        DB      "Mono ",0
BW_TXT          DB      "B/W  ",0

;---------------------------------------------------------------------------
; SHOW_MODE displays the selected video mode number and resolution
;---------------------------------------------------------------------------
SHOW_MODE       PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:BIOS_SEG
                MOV     BL,MODE_SELECT  ;Get selected mode
                MOV     DH,14           ;Put text on row 14
                MOV     DL,LEFT_SIDE
                ADD     DL,9

                MOV     AL,BL           ;Current mode into AL
                MOV     CL,10
                XOR     AH,AH
                DIV     CL              ;Divide by 10
                MOV     BH,AH           ;Save remainder for next digit
                OR      AL,AL           ;Is first digit a zero?
                JNE     TWO_DIGITS      ;If not, display it normally
                MOV     AL," "          ;Make first digit a space
TWO_DIGITS:
                ADD     AL,"0"          ;Convert digit to ASCII
                CALL    DISPLAY_NORMAL  ;First digit of mode number
                MOV     AL,BH
                ADD     AL,"0"
                CALL    DISPLAY_NORMAL  ;Second digit of mode number
                CMP     BL,19           ;Is this mode in table?
                JA      NOT_IN_TABLE
                ADD     DL,3            ;Skip three spaces
                XOR     BH,BH
                MOV     SI,OFFSET TEXT_TXT
                CMP     BL,7
                JE      TEXT_MODE
                JB      NOT_EGA_MODE
                SUB     BL,5
NOT_EGA_MODE:
                CMP     BL,3
                JBE     TEXT_MODE
                MOV     SI,OFFSET GRAPH_TXT
TEXT_MODE:
                CALL    TTY_STRING      ;Show text/graph mode
                INC     DL              ;Skip a space
                MOV     AL,COLOR_TABLE[BX]
                MOV     SI,OFFSET BW_TXT
                DEC     AL
                JZ      SHOW_COLOR
                MOV     SI,OFFSET COLOR_TXT
                DEC     AL
                JZ      SHOW_COLOR
                MOV     SI,OFFSET MONO_TXT
SHOW_COLOR:
                CALL    TTY_STRING      ;Show color/bw mode selected
                INC     DL              ;Skip a space
                SHL     BX,1
                MOV     SI,RES_TABLE[BX]
                CALL    TTY_STRING      ;Display resolution of this mode
NOT_IN_TABLE:
                RET
SHOW_MODE       ENDP

;---------------------------------------------------------------------------
; Interrupt 09 routine.  Watch for trigger key to pop up.
;---------------------------------------------------------------------------
NEWINT09        PROC    FAR
                ASSUME  CS:CSEG, DS:NOTHING, ES:NOTHING
                STI                     ;Allow other interrupts
                PUSHF
                PUSH    AX              ;Must save processor state
                IN      AL,60H          ;Get the scan code
                CMP     AL,HOTKEY       ;Is it the hot key?
                JE      TRIGGER         ;If yes, check the mask
INT09_EXIT:     POP     AX              ;Restore the processor state
                POPF
                JMP     CS:OLDINT09     ;Continue with ROM routine
TRIGGER:        MOV     AH,2            ;Get keyboard status
                INT     16H             ;BIOS keyboard service
                AND     AL,0FH          ;Test only for shift keys
                CMP     AL,SHIFT_MASK   ;Does it match out combination?
                JNE     INT09_EXIT      ;If not, ignore it
                CMP     CS:BUSY_FLAG,0  ;Is SETMODE already active?
                JNZ     INT09_EXIT      ;If active, then exit
                INC     CS:BUSY_FLAG    ;Its active now

                IN      AL,61H          ;These instructions reset KB
                MOV     AH,AL
                OR      AL,80H
                OUT     61H,AL
                MOV     AL,AH
                JMP     SHORT KB_DELAY
KB_DELAY:
                OUT     61H,AL
                CLI
                MOV     AL,20H
                OUT     20H,AL          ;Reset the interrupt controller
                STI

                PUSH    BX              ;Must preserve all registers
                PUSH    CX
                PUSH    DX
                PUSH    BP
                PUSH    SI
                PUSH    DI
                PUSH    DS
                PUSH    ES
                PUSH    CS
                POP     DS              ;Get DS to CSEG
                MOV     AX,BIOS_SEG     ;ES points to BIOS data area
                MOV     ES,AX
                ASSUME  DS:CSEG, ES:BIOS_SEG
                CALL    SETMODE         ;Do the window
                MOV     BUSY_FLAG
                POP     ES              ;Restore all registers
                POP     DS
                ASSUME  DS:NOTHING, ES:NOTHING
                POP     DI
                POP     SI
                POP     BP
                POP     DX
                POP     CX
                POP     BX
                POP     AX
                POPF
                IRET                    ;Now were all done
NEWINT09        ENDP

;---------------------------------------------------------------------------
; Here is the code used to initialize setmode
;---------------------------------------------------------------------------
                ASSUME  CS:CSEG, DS:CSEG, ES:CSEG
EVEN                                    ;Align the buffer
WINDOW_BUFFER   LABEL   BYTE
INITIALIZE:
                MOV     DX,OFFSET COPYRIGHT     ;Do first half of copyright
                MOV     AH,9
                INT     21H

                MOV     AX,1A00H        ;Read display combination code
                INT     10H
                CMP     AL,1AH          ;Is VGA or MCGA present?
                JNE     NO_VGA
                MOV     AH,00100000B    ;Set bit for MCGA adapter
                CMP     BL,08H          ;Is it model 30 with mono?
                JE      SET_BITS
                CMP     BL,0CH          ;Is it model 30 with color?
                JE      SET_BITS
                MOV     AH,00010000B    ;Set bit for VGA adapter
                CMP     BL,7            ;Is it VGA mono?
                JE      SET_BITS
                CMP     BL,8            ;Is it VGA color?
                JE      SET_BITS
NO_VGA:
                XOR     DH,DH
                MOV     AH,0B0H         ;Look for a color adapter
                CALL    LOOK_FOR_CARD
                JNE     NO_COLOR
                OR      DH,00000010B    ;Set bit for color adapter
NO_COLOR:
                MOV     AH,0B0H         ;Look for mono adapter
                CALL    LOOK_FOR_CARD
                JNE     NO_MONO
                OR      DH,00000001B    ;Set bit for mono adapter
NO_MONO:
                MOV     ADAPTER_FLAGS,DH
                MOV     AH,12H
                MOV     BL,10H          ;BIOS get EGA info function
                INT     10H
                CMP     BL,10H          ;Did BL change?
                JE      NOT_EGA         ;If not, no EGA present

                PUSH    ES
                MOV     AX,BIOS_SEG
                MOV     ES,AX
                ASSUME  ES:BIOS_SEG
                MOV     AH,00000100B    ;Set bit for EGA color
                TEST    ES:EGA_INFO,00000010B ;Is an EGA mono attached
                POP     ES
                ASSUME  ES:CSEG
                JZ      SET_BITS
                MOV     AH,00001000B    ;Set bit for EGA mono only
SET_BITS:
                OR      ADAPTER_FLAGS,AH
NOT_EGA:
; Search for any previously installed copy of setmode
                NOT     BYTE PTR START  ;Modify to avoid false match
                XOR     BX,BX           ;Start search at segment zero
                MOV     AX,CS           ;Compare to this code segment
NEXT_SEGMENT:
                INC     BX              ;Look at next segment
                CMP     AX,BX           ;Until reaching this code segment
                MOV     ES,BX
                JE      NOT_INSTALLED
                MOV     SI,OFFSET START ;Setup to compare strings
                MOV     DI,SI
                MOV     CX,16           ;16 bytes must match
                REP     CMPSB           ;Compare DS:SI to ES:DI
                OR      CX,CX           ;Did the strings match?
                JNZ     NEXT_SEGMENT    ;If no match, try next segment
                MOV     DX,OFFSET INSTALLED_MSG
ERR_EXIT:       MOV     AH,9            ;DOS display string service
                INT     21H             ;Display error message
                MOV     AX,4C01H        ;Return error code
                INT     21H             ;Exit to DOS
NOT_INSTALLED:
                ASSUME  ES:NOTHING
                MOV     AX,3509H        ;Get keyboard vector
                INT     21H
                MOV     WORD PTR [OLDINT09], BX  ;Save segment
                MOV     WORD PTR [OLDINT09+2],ES  ;Save offset
                MOV     DX,OFFSET NEWINT09
                MOV     AX, 2509H
                INT     21H             ;DOS function to change vector
```

(SETMODE.ASM continues)

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CIRCLE 140 ON READER SERVICE CARD

■ UTILITIES

```
;-----------------------------------------------------------------
; Deallocate our copy of the enviornment.  Terminate
; and stay resident. Leave code and space for buffer resident.
;-----------------------------------------------------------------

                MOV     AX,DS:[002CH]   ;Get segment of enviornment
                MOV     ES,AX           ;Put it into ES
                MOV     AH,49H          ;Release allocated memory
                INT     21H
                MOV     DX,OFFSET WINDOW_BUFFER + 48*18*2 + 15
                MOV     CL,4            ;Shift four to divide by 16
                SHR     DX,CL           ;Convert size to paragraphs
                MOV     AX,3100H        ;Return success status
                INT     21H

;-----------------------------------------------------------------
; This routine examines memory to look for a display card.
;-----------------------------------------------------------------
LOOK_FOR_CARD   PROC    NEAR
                ASSUME  CS:CSEG, DS:NOTHING, ES:NOTHING
                XOR     SI,SI           ;Look at offset zero
                PUSH    DS
                SUB     AL,AL
                MOV     DS,AX           ;Load the segment register
                MOV     CH,[SI]         ;Store the initial value
                MOV     AL,55H
                MOV     [SI],AL         ;Write pattern of ones and zeros
                JMP     SHORT DELAY     ;A short delay
DELAY:
                MOV     AH,[SI]         ;Read the byte we just wrote
                MOV     [SI],CH         ;Restore the initial value
                POP     DS
                CMP     AL,AH           ;Did it match?
                RET
LOOK_FOR_CARD   ENDP
CSEG            ENDS
                END     START
```

(SETMODE.ASM ends)

gram is popped up, you'll see the current settings for up to four serial ports in the middle window (most PCs have only one or two installed). If you have an internal modem, it too will count as a serial port. Missing (or incorrectly installed) ports are indicated by "n/a" in the bps column.

To change a setting, use the Up and Down Arrow keys to position the moving bar on the desired item. If more than one port is installed, the Left and Right Arrow keys are used. Press either the Plus or Minus key to change the item's value.

Four parameters can be set for each port: bits per second (bps), parity, number of data bits, and number of stop bits. Although the RS-232 standard defines the technical details of the electrical interface, it allows many variations of the basic data format. Which settings will work is generally determined by the device which is connected. For example, most modems work at 1,200 or 2,400 bps, serial printers generally run at 9,600 bps. Both the PC

```
100 REM - BASIC PROGRAM TO CREATE SETMODE.COM
110 CLS:PRINT "Creating SETMODE.COM": OPEN "SETMODE.COM" AS #1 LEN = 1
120 FIELD #1, 1 AS A$: CHECKSUM#=0
130 FOR I = 1 TO   131
140  LINESUM#=0: LOCATE 2,3: PRINT "Countdown: "; 131 - I ;
150  FOR J = 1 TO  16: READ BYTE$: CHECKSUM#=CHECKSUM#+VAL("&H"+BYTE$)
160   LINESUM#=LINESUM#+VAL("&H"+BYTE$)
170   IF (BYTE < 256) THEN LSET A$=CHR$(VAL("&H"+BYTE$)): PUT #1
180  NEXT J
190  READ LINETOT$: LINECHECK# = VAL("&H"+LINETOT$)
200  IF LINECHECK# = LINESUM# THEN GOTO 220
210  LOCATE 4,2: PRINT "Error in line #"; 260 + 10 * I: GOTO 260
220 NEXT I
230 CLOSE: READ FILETOT$ : FILECHECK# = VAL(FILETOT$)
240 IF CHECKSUM# <> FILECHECK# THEN GOTO 260
250 PRINT: PRINT "SETMODE.COM  created successfully": SYSTEM
260 PRINT: PRINT "SETMODE.COM  is not valid!": END
270 DATA E9, 5B,  7, 53, 45, 54, 4D, 4F, 44, 45, 20, 31, 2E, 30, 20, 20,    453
280 DATA 63, 29, 20, 31, 39, 38, 38, 20, 5A, 69, 66, 66, 20, 43, 6F, 6D,    474
290 DATA 6D, 75, 6E, 69, 63, 61, 74, 69, 6F, 6E, 73, 20, 43, 6F, 2E,  D,    5B7
300 DATA  A, 50, 43, 20, 4D, 61, 67, 61, 7A, 69, 6E, 65, 20, FE, 20, 54,    578
310 DATA 6F, 6D, 20, 4B, 69, 6D, 6C, 6B, 65, 6E,  D,  A, 4B, 6F, 74, 6B,    56F
320 DATA 6F, 79, 20, 69, 73, 20, 41, 6C, 74, 2D, 4D, 24, 1A,  D,  A, 41,    428
330 DATA 6C, 72, 65, 61, 64, 79, 20, 49, 6E, 73, 74, 61, 6C, 6C, 65, 64,    641
340 DATA 24,  2,  1, 53, 45, 54, 4D, 4F, 44, 45, 20, 31, 2E, 30, 20, 20,    327
350 DATA 20, 10, 20, 19, 20, 1A, 20, 1B, 20, 2B, 20, 2D, 20, 20, 3C, 43,    23D
360 DATA 52, 3E, 20, 45, 73, 63,  0,  4,  4, 43, 4F, 4D, 4D, 55, 4E, 49,    3EB
370 DATA 43, 41, 54, 49, 4F, 4E, 20, 50, 4F, 52, 54, 53,  0,  2,  5, 50,    3CD
380 DATA 6F, 72, 74, 3A,  0, 10,  5, 31,  0, 17,  5, 32,  0, 1E,  5, 33,    279
390 DATA  0, 25,  5, 34,  0,  2,  6, 42, 70, 73, 3A,  0,  2,  7, 50, 61,    27F
400 DATA 72, 69, 74, 79, 3A,  0,  2,  0, 44, 61, 74, 61, 20, 62, 69, 74,    4E5
410 DATA 73, 3A,  0,  2,  9, 53, 74, 6F, 70, 20, 42, 69, 74, 73, 3A,  0,    44A
420 DATA  2,  A, 44, 53, 52, 3A,  0,  4,  D, 44, 49, 53, 50, 6C, 41, 59,    356
430 DATA  0,  4,  E, 4D, 6F, 64, 65, 3A,  0,  2,  F, 30, 20, 31, 20, 32,    2B5
440 DATA 20, 33, 20, 34, 20, 35, 20, 36, 20, 37, 20, 31, 33, 20, 31, 34,    2B2
450 DATA 20, 31, 35, 20, 31, 36, 20, 31, 37, 20, 31, 38, 20, 31, 39,  0,    2A8
460 DATA  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,      0
470 DATA  0,  0, 36, 36, 36, 36, 36, 36, 36, 19,  0,  0,  0,  0,  0, 14,    1A7
480 DATA 14, 18, 14, 30, 18, 30, 18, 18, 20, 20, 20, 20, 20, 30,  0,  0,    1A0
490 DATA  0,  0,  0, 10, 18, 30, 18, 20, 20, 20, E0, 3E,  3, 26, FF, 37,    345
500 DATA 26, AB, 49,  0, 24, 7F, A2, 3B,  2, C6,  6, 3C,  2,  1, BB,  7,    45E
510 DATA 70, 3C,  7, 74, 21, BB,  3,  5, C6,  6, 3C,  2,  0, 3C,  3, 77,    3CB
520 DATA DC, 0A, FC, 80, F7, 77, 89, 1E, 34,  2, BF, 5E,  0, 26, 8A, 16,    718
530 DATA 4A,  0, 80, EA, 28, D0, EA, 88, 16, 3A,  2, 32, F6, C6,  6, 31,    695
540 DATA  2,  1, E0, 3D,  2, C6,  6, 31,  2,  6, E0, 35,  2, C6,  6, 31,    448
550 DATA  2,  3, E0, 2D,  2, BE, 71,  1, AD,  A, C0, 74,  B, 8B, D0,  2,    59F
560 DATA 16, 3A,  2, E0, 8B,  2, EB, F8, 26, 88, 3E, 49,  0, 13, 77,  C,    565
570 DATA E8,  0,  2, FE, C2, B6, 10, B0, 1E, E8, 80,  2, E0, EC,  2, E8,    866
580 DATA 8E,  4, 8A, 2E, 35,  2, E8, 96,  1, 32, E4, CD, 16, 50, 8A, 2E,    601
590 DATA 34,  2, E8, 8A,  1, 58, 80, FC, 48, 75, 15, 26, 83, 3E,  0,  0,    536
600 DATA  8, 74, D9, FE,  E, 3D,  2, 79, D3, C6,  6, 3D,  2,  4, EB, CC,    6AA
610 DATA 80, FC, 50, 75, 12, FE,  6, 3D,  2, 88, 3E, 3D,  2,  4, 76, BC,    5C9
620 DATA C6,  6, 3D,  2,  0, EB, B5, 88, FC, 4D, 75,  5, B0,  1, E9, 77,    6FE
630 DATA  0, 88, FC, 4B, 75,  5, B0, FF, E8, 6D,  0, 3C, 2B, 75,  5, B1,    6D7
640 DATA  1, E9, A8,  0, 3C, 2D, 75,  5, B1, FF, E9, 9F,  0, 80, FC,  1,    72A
650 DATA 74,  6, 3C,  D, 74,  9, EB, B4, 26, A8, 49,  0, A2, 3B,  2, 32,    4CF
660 DATA F6, BE, 5E,  0, B9, 20,  0, 8A, 16, 3A,  2, AD, E0, F1,  1, E2,    748
670 DATA FA, FE, C6, 88, FE, 12, 75, EC, E8, 10,  2, 26, 8F,  7, 8A, 1E,    88D
680 DATA 3B,  2, 26, 3A, 1E, 49,  0, 74, 1E, 32, FF, 8A, 8F, 56,  2, 26,    45E
690 DATA A1, 10,  0, 24, CF,  A, C1, 26, A3, 10,  0, 8B, C3, CD, 10, B4,    627
700 DATA  2, 33, D2, 32, FF, CD, 10, C3, 88, 3E, 3D,  2,  0, 74, 1A, 8A,    5ED
710 DATA 1E, 3E,  2,  2, D0, 88, 1E, 3E,  2, 80, FB,  3, 77, EA, 32, FF,    62E
720 DATA D1, E3, 26, 83, 3F,  0, 74, E8, C3, 88, 3E, 41,  2,  0, 74, 1B,    643
730 DATA 8A, 1E, 3B,  2,  2, D8, 88, 1E, 3B,  2, 80, FB, 13, 77, EA, 32,    5CJ
740 DATA FF, 8A, 8F, 42,  2, 22,  E, 41,  2, 74, DE, C3, 8A, 1E, 3E,  2,    5CC
750 DATA 32, FF, D1, E3, 26, 8B, 17, 83, C2,  3, 8A, 26, 3D,  2, FE, CC,    7AE
760 DATA 74,  F, FE, CC, 74, 3B, FE, CC, 74, 5B, FE, CC, 74, 65, E9, CB,    9EC
770 DATA FE, E8, C1,  2, 80, F9,  1, 75, 11, 83, FB,  3, 75,  1, 43, D1,    7B4
780 DATA E0,  0, D8, 75, 16, B8, 80,  1, EB, 11, D1, E3, 83, FB,  4, 75,    83F
790 DATA  1, 4B, 81, FB, 80,  1, 76,  3, B8,  1,  0, E8, 97,  2, E9, 9B,    683
800 DATA FE, EC, 8A, D8, 24, C7, D0, EB, D0, EB, D0, EB,  2, D9, 80, E3,    BA6
810 DATA  7, F6, C3,  1, 75,  5, F6, C3,  6, 75, F1, D6, E3, D8, E3, D8,    996
820 DATA E3,  A, C3, EB, 11, EC, 8A, E0, 80, E4, FC,  2, C1, 24,  3,  A,    856
840 DATA C4, E8,  3, EC, 34,  4, EE, E9, 62, FE,  0,  6,  5,  1,  1, 8A,    6A4
850 DATA 36, 3D,  2,  A, F6, 74, 28, 8A, DE, 32, FF, 8A, 8F, 9A,  4, 80,    6E1
860 DATA C6,  5, 88,  7, F6, 26, 3E,  2,  4, 11, 2A, C1,  2,  6, 3A,  2,    422
870 DATA 8A, D0, E8, D6,  0, 8A, E5, E8, B6,  0, FE, C9, 75, F4, C3, 88,    A90
880 DATA 3E, 3B,  2, 13, 77, F8, E8, 1A,  0, B6,  F, B1,  2, EB, E3,  1,    646
890 DATA  3,  5,  7,  9,  B,  D,  F,  0,  0,  0,  0,  0, 12, 15, 18, 1B,     99
900 DATA 1E, 21, 24, 8A, 1E, 3B,  2, 32, FF, 8A, 97, DF,  4,  2, 16, 3A,    4CF
910 DATA  2, C3,  A, F6, 74,  0, B0, 20, B9, 20, 20, E0, 1F,  0, B0, C9,    68A
920 DATA B9, CD, BB, E0, 17,  0, B0, BA, B9, 20, BA, E0,  F,  0, FE,  E,    B40
930 DATA 31,  2, 75, F2, B0, C8, B9, CD, BC, E0,  1,  0, C3, 8A, 16, 3A,    7DA
940 DATA  2, E8, 18,  0, C6,  6, 32,  2, 26, 8A, C1, E0,  E,  0, FE,  E,    575
950 DATA 32,  2, 75, F5, 8A, C5, E0,  3,  0, FE, C6, C3, 50, E8, 4B,  0,    7E2
960 DATA 80, 3E, 3C,  2,  1, 74,  4, 8A, 26, 34,  2, B9,  5, 47, 47, 50,    3CF
970 DATA 80, 3E, 3C,  2,  1, 74,  6, A0, 88, 74,  2, B0, 2A, E8,  C,  0,    4E3
980 DATA C3, AC,  A, C0, 74,  5, E0,  3,  0, EB, F6, C3, 8A, 26, 34,  2,    727
990 DATA 53, 51, E8, 26,  0, 26, 89, 17, 8A, DC, 26, 3A, 3E, 62,  0, 89,    5E7
1000 DATA  1,  0, B4,  9, CD, 10, 59, 5B, FE, C2, C3, E8,  D,  0, 26, 89,    676
1010 DATA 17, 26, 8A, 3E, 62,  0, B4,  8, CD, 10, C3, 26, 8A, 1E, 62,  0,    4F3
1020 DATA 32, FF, D1, E3, 81, C3, 50,  0, C3, 59, 65, 73,  0, 20, 4E, 6F,    74A
1030 DATA  0, 6E, 2F, 61,  0, 20, 4E, 6F, 6E, 65,  0, 20, 20, 4F, 64, 64,    405
1040 DATA  0, 20, 45, 76, 65, 6E,  0, 53, 70, 61, 63, 65,  0, 20, 4D, 61,    468
1050 DATA 72, 6B,  0, CB,  5, D1,  5, D7,  5, DD,  5, 33, DB, 80, 1E, 31,    626
1060 DATA  2, B0,  7, F6, E3, D0, E0, B9, 10,  6,  2,  E, 3A,  2,  2, C8,    62F
1070 DATA 26, 8B, 17, 8B, EA,  8, D2, 75,  E, BE, C1,  5, 8B, D1, 80, EA,    7E7
1080 DATA  2, E8, 5D, FF, E9, C9,  0, 80, 30, 8B, D1, E0, 5E, FF, 8B, D5,    9D9
1090 DATA 83, C2,  3, E8, CF,  0, 53, E8, CB,  0, 5B,  8, DB, 74, 46, 33,    733
1100 DATA D2, B8,  0, 2D, F7, F3, C6,  6, 32,  2,  6, 51, 8B, F1, 8B,  A,    739
1110 DATA  0, 8B, D0, 33, C0, 8B, CA, 33, D2, F7, F3, 91, F7, F3, 92,  4,    9A3
1120 DATA 30, 52, 4E, 8B, D6, E8, 24, FF, FE,  8, 32,  2, 5A, 8B, C1,  8,    72D
1130 DATA CA, 75, E2, 8B, D6, FE, CA, B8, 20, E8, 10, FF, FE, CA, FE,  E,    AE5
1140 DATA 32,  2, 75, F1, 59, 8B, D5, 83, C2,  3, EC, 58, BE, C5,  5, A8,    887
1150 DATA  0, 74,  F, 25, 30,  0, D1, E8, D1, E0, D1, E8, 8B, F0, 8B, B4,    8C5
1160 DATA E3,  5, 8B, D1, 80, EA,  4, 80, C6,  1, E8, D4, FE, 50, 58, 24,    87F
1170 DATA  3,  4, 35, 8B, D1, 88, C6,  2, E8, D1, FE, 5A, 52, B0, 31, F6,    81A
1180 DATA C2,  4, 74,  2, FE, C0, 8B, D1, 80, C6,  3, E8, BE, FE, 8B, D5,    9A3
1190 DATA 83, C2,  6, EC, BE, BD,  5, A8, 20, 74,  3, BE, B9,  5, 8B, D1,    7CE
1200 DATA 89, C6,  4, 80, EA,  2, E8, 98, FE, 58, 8B, D5, 83, C2,  3, EE,    922
1210 DATA 8A, 1E, 31,  2, 32, FF, 43, 43, 80, FB,  8, 73,  7, 80, 1E, 31,    566
1220 DATA  2, E9, FD, FE, C3, EC, 8A, E8, B0, 80, EE, 83, EA,  3, EC, 86,    AFF
1230 DATA D0, EE, 42, EC, 86, F8, EE, 42, 42, 8A, C4, EE, C3,  1,  2,  1,    8E7
1240 DATA  2,  2,  1,  1,  3,  2,  2,  3,  2,  1,  2,  2, 3A,  7, 3A,  7,     99
1250 DATA 42,  7, 42,  7, 4A,  7, 4A,  7, 52,  7, 42,  7, 5A,  7, 52,  7,    298
1260 DATA 62,  7, 62,  7, 6A,  7, 6A,  7, 5A,  7, 32, 35, 78, 34, 30, 28,    378
1270 DATA 28,  0, 32, 35, 78, 38, 30, 28, 28,  0, 33, 32, 38, 78, 32, 38,    316
1280 DATA 38,  0, 36, 34, 38, 78, 32, 38, 38,  0, 33, 32, 38, 78, 32, 38,    343
1290 DATA 38,  0, 36, 34, 38, 78, 33, 35, 38,  0, 36, 34, 38, 78, 34, 38,    358
1300 DATA 38,  0, 54, 65, 78, 74, 28,  0, 47, 72, 61, 78, 68,  0, 43, 6F,    499
1310 DATA 6C, 6F, 72,  0, 4D, 6F, 6E, 6F, 28,  0, 42, 2F, 57, 28, 28,  0,    48E
1320 DATA 8A, 1E, 3B,  2, B6,  E, 8A, 16, 3A,  2, 88, C2,  9, 8A, C3, B1,    5CE
1330 DATA  A, 32, E4, F6, F1, 8A, FC,  A, C0, 75,  2, B0, F8,  4, 38, E0,    88A
1340 DATA CA, FD, 8A, C7,  4, 30, E8, C3, FD, 80, FB,  8, 73,  7, 80, 1E,    97D
1350 DATA  3, 32, FF, BE, 72,  7, 80, FB,  7, 74,  D, 72,  3, 80, EB,  5,    653
1360 DATA 80, FB,  3, 76,  3, BE, 78,  7, E0, 96, FD, FE, C2, 8A, 07,  D,    88D
1370 DATA  7, BE, 8A,  7, FE, C8, 74,  A, BE, 7E,  7, FE, C8, 74,  3, BE,    7D8
1380 DATA 84,  7, E8, 7C, FD, FE, C2, D1, E3, 8B, B7, 1C,  7, E8, 71, FD,    A1B
1390 DATA C3, FB, 9C, 50, E4, 60, 3C, 32, 74,  7, 58, 9D, 2E, FF, 2E, 36,    75D
1400 DATA  2, B4,  2, CD, 16, 24,  F, 3C,  0, 75, EF, 2E, 80, 3E, 33,  7,    497
1410 DATA  0, 75, E7, 2E, FE,  6, 33,  2, E4, 61, 8A, E0,  C, 80, E6, 61,    745
1420 DATA 8A, C4, EB,  0, E6, 61, FA, B0, 20, E6, 20, FB, 53, 51, 52, 55,    896
1430 DATA 56, 57, 1E,  6,  E, 1F, B0, 48,  0, 8E, C0, E0, 1C, FA, FE,  E,    64E
1440 DATA 33,  2,  7, 1F, 5F, 5E, 5D, 5A, 59, 5B, 58, 9D, CF, 90, BA,  3,    594
1450 DATA  1, B4,  9, CD, 21, B0,  0, 1A, CD, 10, 3C, 1A, 75, 10, B4, 20,    512
1460 DATA B0, FB,  8, 74, 49, B0, FB,  C, 74, 44, B4, 10, B0, FB,  7, 74,    73C
1470 DATA 3D, B0, FB,  0, 74, 38, 32, F6, B4, E0, E0, 88,  0, 75,  3, B0,    768
1480 DATA CE,  2, B4, B0, E8, 7E,  0, 75,  3, B0, CE,  1, B0, 36, 41,  2,    662
1490 DATA B4, 12, B3, 10, CD, 10, B0, FB, 10, 74, 17,  6, B0, 40,  0, 8E,    688
1500 DATA C0, B4,  4, 26, F6,  6, B7,  0,  2,  7, 74,  2, B4,  8,  0, 26,    48A
1510 DATA 41,  2, F6, 16,  0,  1, 33, DB, 8C, C0, 43, 3B, C3, 8E, C3, 74,    6B8
1520 DATA 1A, BE,  0,  0,  1, 8B, FE, B9, 10,  0, FJ, A6,  B, C9, 75, EB, BA,    7B2
1530 DATA 5D,  1, B4,  9, CD, 21, B0,  1, 4C, CD, 21, B8,  9, 35, CD, 21,    5E0
1540 DATA B9, 1E, 36,  2, 8C,  6, 38,  2, BA,  1,  0, B0,  9, 25, CD, 21,    442
1550 DATA A1, 2C,  0, 8E, C0, B4, 49, CD, 21, BA,  D,  E, B1,  4, D3, EA,    74D
1560 DATA B0,  0, 31, CD, 21, 33, F6, 1E, 32, C0, 8E, D0, 8A, 2C, B0, 55,    731
1570 DATA 80,  4, EB,  0, 8A, 24, 8E, 2C, 1F, 3A, C4, C3,  0,  0,  0,  0,    4B9
1580 DATA 282249
```

SETMODE.BAS: *A BASIC program that will automatically create SETMODE.COM.*

■ UTILITIES

and the remote device it is communicating with must use identical settings. For a more detailed discussion of RS-232 communications, see the sidebar "Speaking the RS-232 Language."

SETMODE also displays the current state of the Data Set Ready (DSR) line. This value is read from pin 6 of the standard 25-pin connector. A "Yes" indicates the attached device is connected and powered up (although not necessarily online). If you have an internal modem, the DSR should always be active. A "No" is a sign that no connection has been made or the remote device is not operating. You can use this feature to determine if your equipment is attached and working properly. Normally the DSR indication should be on when equipment is attached properly.

WORDS OF CAUTION Since SETMODE deals directly with the machine's hardware, it is a very powerful program. While nothing you can do with SETMODE can damage your hardware, if you use the program incorrectly you can send your hardware into a tailspin. To prevent this from happening, you'll have to follow a couple of simple rules.

First, although SETMODE has enough smarts to keep you from switching to a video mode that isn't supported by your equipment, it won't prevent you from switching modes at the wrong time. To avoid problems, change modes only when at the DOS prompt rather than while running another program. Most software can't tolerate a video mode change and will revolt, either by doing nothing or by displaying garbage on the screen. When in doubt, selecting mode 3 for color monitors and mode 7 for monochrome should put things back to normal. These are the standard text modes and can be used by most software.

A second possible problem could arise if you pop up while a file transfer (which uses the serial port) is in progress. When SETMODE reads the communication port settings, it could interfere with the port's operation. Worse yet, if you changed the protocol parameters during a file transfer, the carrier signal could be disrupted. Again, making changes only when at the DOS prompt is recommended.

YOUR PERSONAL HOTKEY You can change the default Alt-M hotkey combination in one of two ways. If you have the program source code and an assembler, you can easily modify the equates for SHIFT_MASK and HOTKEY. Also change the text at label "COPYRIGHT" to display the new hotkey. Then reassemble and link the program and use EXE2BIN to convert the resulting executable file into the .COM format, as usual.

If you're starting with the .COM version of SETMODE, you can use DEBUG to make the changes. Values for the shift mask and scan codes can be found in Figure 3 and Figure 4, respectively. Notice the values are all in hexadecimal notation. The following example illustrates how to change the hotkey to Ctrl-X:

```
DEBUG SETMODE.COM
E 14C "Hotkey is Ctrl-X"
E 807   2D      ;Desired Scan code
E 818   04      ;Desired Shift Mask
W
Q
```

Be sure to enter *exactly* 16 characters (excluding the quotation marks) in the line

SHIFT_MASK Value Table

SHIFT_MASK value	Shift key (● = Pressed) Alt	Ctrl	Left Shift	Right Shift
0				
1				●
2			●	
3			●	●
4		●		
5		●		●
6		●	●	
7		●	●	●
8	●			
9	●			●
A	●		●	
B	●		●	●
C	●	●		
D	●	●		●
E	●	●	●	
F	●	●	●	●

Figure 3: *The combination of shift keys needed to pop up the program corresponds to a unique SHIFT_MASK value. Use this value when altering the program's default activation keys as explained in the article.*

Keyboard Scan Codes for Alternative Hotkeys

Key	Scan code in hex	Key	Scan code in hex
Esc	01	Z	2C
!1	02	X	2D
@2	03	C	2E
#3	04	V	2F
$4	05	B	30
%5	06	N	31
^6	07	M	32
&7	08	<,	33
*8	09	>.	34
(9	0A	?/	35
)0	0B	Right Shift	36
_-	0C	PrtSc*	37
+=	0D	Alt	38
Backspace	0E	Spacebar	39
Tab	0F	CapsLock	3A
Q	10	F1	3B
W	11	F2	3C
E	12	F3	3D
R	13	F4	3E
T	14	F5	3F
Y	15	F6	40
U	16	F7	41
I	17	F8	42
O	18	F9	43
P	19	F10	44
{[	1A	NumLock	45
}]	1B	ScrollLock	46
Enter	1C	7 Home	47
Ctrl	1D	8 Up Arrow	48
A	1E	9 PgUp	49
S	1F	–	4A
D	20	4 Left Arrow	4B
F	21	5	4C
G	22	6 Right Arrow	4D
H	23	+	4E
J	24	1 End	4F
K	25	2 Down Arrow	50
L	26	3 PgDn	51
:;	27	0 Ins	52
"'	28	. Del	53
~`	29	SysReq	54
Left Shift	2A	F11	57
|	2B	F12	58

Figure 4: *If the key combination used to activate the program is not to your liking, it may be easily changed to another setting. You may choose a new hotkey from the table above and then substitute the scan code for the key in the program as directed in the article. This ability to change keys adds to the SETMODE program's flexibility.*

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SETMODE BY MODEM

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SETMODE.COM is already compiled and ready to run. SETMODE.BAS will automatically create SETMODE.COM when run once in BASIC. SETMODE.ASM allows you to modify the program, but requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM SETMODE;
LINK SETMODE;
EXE2BIN SETMODE SETMODE.COM
```

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.

SETMODE Command

Tom Kihlken

1988 No. 13 (Utilities)

Purpose: Provides menu-driven setup and change of video modes and communications parameters.

Format: `[d:][path]SETMODE`

Remarks: SETMODE is a memory-resident utility that may be loaded either at the DOS prompt or by being included as a line in an AUTOEXEC.BAT file. It takes no parameters. Its default hotkey is Alt-M, and it will pop up in either text or graphics mode.

The SETMODE window displays the current settings (bps, parity, data bits, stop bits) for up to four installed serial ports. Settings can be changed by moving the bar menu highlight to the desired parameter with the cursor arrow keys and using the Plus or Minus key to increment or decrement the value. Pressing either Esc or Enter removes the SETMODE screen and implements any communications parameter changes. The status of the Data Set Ready (DSR) line is also shown in the window, though it cannot be changed through SETMODE.

The current video mode is also displayed in the SETMODE pop-up window and can be changed by moving the menu bar to the desired mode and pressing Enter. Note that modes not supported by the display adapter(s) in the user's system cannot be selected. When a video mode change is made, the screen is left blank; pressing Enter a second time will restore the normal prompt.

Note: Although SETMODE will pop up over most existing applications, video mode changes should normally be made only from the DOS prompt, as many programs will crash if the mode is changed while they are running. Similarly, changes in communications protocols should not be made while a file transfer is in progress. Text characters beneath the SETMODE window are preserved if the mode is left unchanged, but graphics images are not.

Instructions for changing the default Alt-M hotkey are contained in the article.

that begins with "Hotkey is." If necessary, you should pad the string with blanks. It would be a good idea to keep a copy of the original program before modifying it with DEBUG. If you make a mistake, just enter "Q" to quit DEBUG and start over.

INSIDE THE CODE Now that we've seen what SETMODE does, let's take a look at how it works. From a programming standpoint, the logic is fairly simple. There are two main sections: the initialization routine and the resident portion. The very first instruction of the program contains a jump to the initialization portion, which can be found at the end of the program. Since the initialization routine is only needed once, it is later overlaid by the window buffer.

As usual, the first step is to determine if the program is already installed. Loading multiple copies of the same resident program would cause havoc with the system. A search through the computer's memory will reveal any existing copies, and if one is found the program simply terminates with an exit code of 1. Otherwise the installation continues by testing for the various display adapters (I'll explain how this is done shortly).

Two more steps are required before the program is ready to become a resident part of your system. First, the keyboard interrupt vector must be intercepted, to permit detection of the hotkey combination. DOS provides function calls that make this easy. Function 35h returns the current vector, and we save this address so we can JMP to it later. The new segment and offset are then placed into the vector table with function 25h. Second, before terminating, we release the memory occupied by our copy of the environment. We'll have no need for it and DOS can make use of it later.

The special terminate-and-stay-resident function is then used to return control to the operating system. A return code of 0 is passed back to indicate the installation was successful. The amount of memory reserved is just enough for the resident code and the window buffer. The window buffer is sized to hold the underlying display of 18 rows of 40 columns. Two bytes are re-

SPEAKING THE RS-232 LANGUAGE

Getting the protocol values correct is one of the most troublesome chores when communicating with serial devices. The data being transmitted consists of a series of carefully timed electrical signals. These signals are generated by a universal asynchronous receiver/transmitter (UART), which, in the IBM PC, is an Intel 8250. This chip converts a single byte of data into the required electrical pulses and provides several control signals that may be read and set by the system microprocessor.

Although the RS-232 standard has specified most communications parameters, there are still many possible protocols available. Both transmitter and receiver must obey the same timing rules for a successful transfer of data. To fully understand the required settings, here is a short course in asynchronous data transmission.

In *asynchronous* communications, the transmitter can send a word whenever it wants: it does not have to be locked in step with the receiver. Each word transmitted consists of a start bit, data bits, and framing bits. The exact format can be controlled by the communications software and is commonly known as the protocol. The layout of the series of pulses is shown in Figure A below.

The start bit is used to indicate when a word of data is about to arrive. When no data is flowing, the line is held in a mark state. Since an asynchronous system allows words to arrive at any time, a start bit is required to synchronize the timing of both systems. The data bits follow immediately thereafter, each one spaced one bit time apart. The common data formats utilize 7 or 8 bits in each word, though the UART itself allows anywhere from 5 to 8. If you hear about file transfer programs that can't send "high" bit characters, it's almost certainly because they use a 7-bit data format.

Following the data, the parity and stop bits are added. Logically enough, the stop bit marks the end of a word and returns the line to the idle state. The parity bit is generated by the UART hardware and can be used to detect transmission errors. This bit can be used in any one of five distinct ways: even, odd, mark, space, and none. When even parity is used, the parity bit is adjusted so that each word contains an even number of 1-bits. Odd parity is just the opposite. With mark parity the bit is always set, and with space parity it is always zero. No parity indicates the bit is missing entirely. Although parity allows the UART hard-

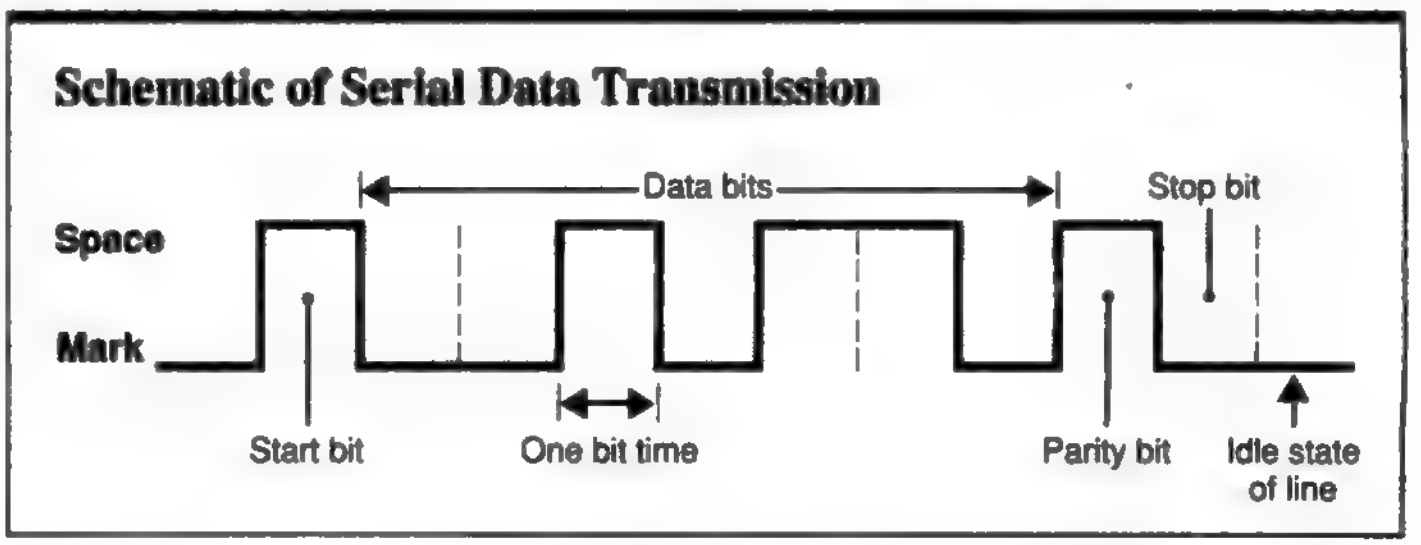

Figure A: *A series of signals such as these are generated by the UART to transmit each byte through the serial port.*

quired for each character—one for the character itself, the second for the attribute.

The resident code consists of two main procedures: the interrupt service routine for the keyboard, and the SETMODE routine itself. The purpose of the keyboard handler is straightforward. It examines every keystroke, comparing the scan codes with the selected hotkey. When a match is found, it checks the state of the shift, Ctrl, and Alt keys to determine if the correct one is also depressed. If not, control is passed to the original keyboard routine. When the correct hotkey combination is found, the keyboard is reset and all the registers are pushed on the stack (interrupt routines must always preserve the processor state). The main logic routine SETMODE is then called.

The first step in building the window is to save the cursor location (we'll be moving it about the screen to read and write characters). Then the underlying characters are read from the screen as the window is constructed. First, the border is drawn and the center filled with blanks. The text is added next. The two routines SHOW_PORTS and SHOW_MODE are then called to fill in the current settings of the system. The last step before soliciting a keystroke is to place the moving bar on the current item. Creating the moving bar is accomplished by reading the affected characters from the screen and writing them back with a new attribute.

The BIOS read keyboard routine is used to wait for the next keypress. When it arrives, we compare it with the seven possible command keys (Plus, Minus, Esc, and the four cursor arrows). If it doesn't match, we simply ignore it and wait for another key. Otherwise, the moving bar is erased (it will be replaced shortly) and the appropriate logic routine is called to process the command.

When an arrow key is pressed, several checks need to be made before moving the bar. Before a new video mode can be chosen, the bits in ADAPTER_FLAGS are ORed with a table to determine if the required adapter is present. If the result is zero, the mode is skipped and the bar moves to the next selection. The result is that only modes supported by the available hardware are allowed. A similar test is made when moving from one communications port to the next. The bar can be moved only if a valid port address is found in the BIOS data area.

When Enter is finally pressed, the original window is copied back to the screen. Next, the selected video mode is compared with the starting mode. If it's different, a mode change is required. To cause a mode change requires reprogramming a number of registers in the CRT controller chip. Gathering all the required data to do this for each adapter would have been a programmer's nightmare; luckily, the BIOS provides services that make it easy. The desired mode number is placed in register AL, AH is set to zero, and an interrupt 10h is executed. An extra step is required to accommodate multiple display adapters.

The BIOS maintains a word at address 0040:0010 that contains the equipment list. Bits 4 and 5 specify what type of display is attached. The initial value for these is read from the DIP switches on the motherboard when the machine boots. Normally, with only one display adapter, they need never change. But when two adapters are present, the equipment list must correctly indicate which display is active. SETMODE uses the OR instruction to place the correct value into this word each time it changes the mode.

THE PROGRAMMER'S NOTEBOOK

When programing in assembly language, there are always a number of interesting

---

ware to detect line errors, it is in fact seldom used. Instead, more-advanced error detection and correction is done through software. When software error detection is used, the parity bit is normally omitted to reduce transmission overhead.

The number of bits per second indicates the speed of the data link. To send a byte of data normally requires about 10 bits (including the start and stop bits), so the effective throughput for a 1,200-bps signal would be 120 bytes per second. Not long ago 1,200 bps was considered high speed. Today, 9,600-bps modems are available, and PC-to-PC communications using a direct connection can run even faster. On the PC and AT the maximum rate supported by the basic input output system is 9,600 bps. The new PS/2 machines have increased this to 19,200 bps. SETMODE allows you to set values up to a maximum of 115,200 bps, which is the absolute highest rate that can be programmed into the UART. Your modem probably won't be able to run that fast, but it is possible for it to conduct PC-to-PC communications at that speed. You'll need a high-performance communications software package and a null modem cable to connect the two serial ports.

To program the desired line settings, SETMODE must correctly set the internal registers of the UART. These registers are mapped into ports that are accessible to the central processor with IN and OUT instructions. Each communications adapter is assigned a unique series of port numbers, which are defined by the base address of the first register. The base address of each installed adapter can be found in the BIOS data area starting at address 0040:0000. Normally, the first serial port adapter is installed at address 3F8h and the second at 2F8h. If you've ever had to move a jumper on a serial port adapter board, these are the values that are affected.

When the UART starts sending, the data is transmitted on one of the 25 pins of the RS232 connector (the AT utilizes a 9-pin connector). A second pin is used for incoming data. Other pins can be used for various control signals but are not required for simple communications. The only one of interest here is the data set ready (DSR), which is an input to the PC. A modem raises this line to indicate it is ready to receive data. SETMODE reports the state of the data set ready line with either a Yes or a No.

—Tom Kihlken

■ UTILITIES

problems that must be solved, a couple of which are illustrated by certain details in SETMODE.

When a window is popped up over an existing program screen, the current screen display must be preserved so that it can be replaced when the window is removed. There are two common (and lightning-fast) methods of doing this. One method utilizes the display adapter's ability to store and display more than one page. The other method involves reading and writing the character/attribute data directly from display memory. However, SETMODE uses a different method, which, although much slower, has the advantage of working equally well in graphics and text modes.

The three SETMODE windows always occupy 18 rows of 40 columns each. The computer's Basic Input/Output System (BIOS) routines are used to read and write to the screen. These routines are designed to work in any of the available video modes. To read (or write) a character, the cursor is placed on the desired row/column and interrupt 10h is used to read (write) the data. Actually, I use a shortcut to save the time required to move the cursor. Instead of executing a BIOS function to move the cursor, the desired cursor location is written into the BIOS data area. (The read/write character functions always use the cursor location stored in memory, not its actual physical location.)

I mentioned above that the BIOS read character function works even in graphics modes, and this is not exactly true. It works only if normal character data is being displayed.

If a graphics display is present, the BIOS cannot read it. For this reason, graphics displays are not fully restored when a window is removed. The alternative is to store the entire graphics memory. I did not use this technique since it would require considerably more memory.

How SETMODE knows which display modes it can and cannot use is another programming detail of interest. The answer lies in the initialization routine. Six display options can be recognized: the monochrome display adapter (MDA), the color/graphics adapter (CGA), the enhanced graphics adapter with color monitor (EGA), an EGA with a monochrome display, the MCGA found on the new Model 30, and the new video graphics adapter (VGA). Each of these adapters can support only certain modes. Most other adapters emulate one of these and don't require any special consideration. The ADAPTER_FLAGS byte has a bit that is set for each adapter in the machine. When switching modes, if the required adapter bit is not set, the mode is not allowed.

Now for the problem of finding the system's adapter(s). To determine if the MDA and CGA adapters are present, the

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Sales	Client file	87
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adapter's video buffer (at segments B000h and B800h) is examined. First, the byte at offset 0 is read and stored. Next the binary value 55h is written to the same location. After a short delay (to allow sufficient time for the display memory to react) the byte is read and compared with 55h. If it matches, a video adapter is assumed to be installed. The original value is then restored so that the display remains unaltered.

The method outlined in the IBM BIOS Interface *Technical Reference* manual is used to test for the presence of a MCGA, VGA, and EGA. First, to test for the VGA, we issue INT 10h with AX equal to 1A00h. This function reads the display combination code. If AL is not still equal to 1AH on return, there is no MCGA or VGA in the system. Otherwise, the value returned in register BL determines which display is in use. Similarly, to determine if an EGA is present, the EGA information function is used (INT 10h is issued with AH equal to 12h and BL equal to 10h). If, on return, BL is still equal to 10h, there is no EGA in the system.

Another interesting problem arose in connection with displaying the bps setting of the serial ports. This value is set by loading a divisor into the UART's registers. The UART converts the divisor into bps using the equation

```
bps = 115200 / divisor
```

For a 16-bit processor, division with a number of this magnitude is no problem as long as the result is no greater than 65,535 (64K). But what if the bps rate is set greater than this? A divide overflow would result, producing a type 0 interrupt. This would then require special consideration, since it occurs from within a resident program. A little high school algebra eliminates the problem completely, however. Since we know all a normal bps rate is a multiple of 10, we divide the numerator by 10 and thus use 11,520 instead of 115,200 in the above equation. To produce the correct answer, the result is then simply multiplied by 10, i.e., a zero is appended to it.

One last consideration is needed in the above operation. Suppose the bps divisor was set to zero? (Inadvertently dividing by zero has long been a trouble area when evaluating mathematical equations.) The result of the division would be undefined and an interrupt 0 would be executed. To preclude this possibility a special test is made, and if SETMODE finds a divisor of zero, the division is simply not performed.

If your experience with the MODE command has been one of love and hate—with more of the latter—you now have an alternative. SETMODE can at least give you a fighting chance in the war between you and your peripherals. PC

Tom Kihlken is an occasional contributor to PC Magazine.

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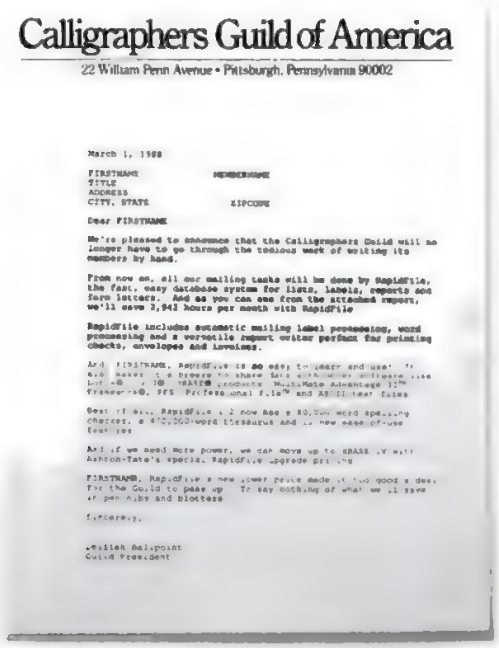

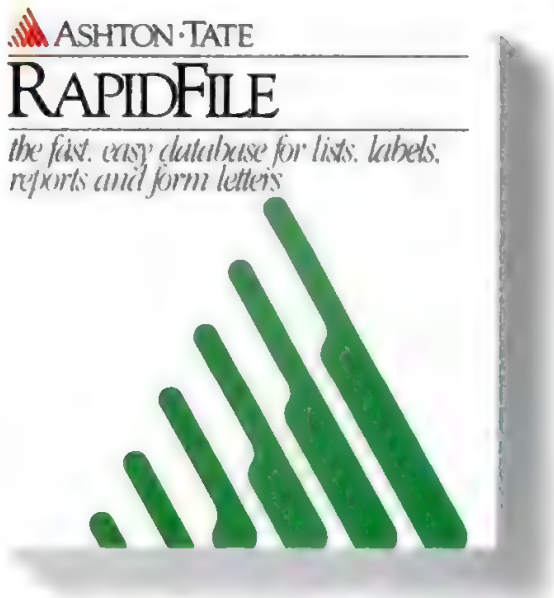

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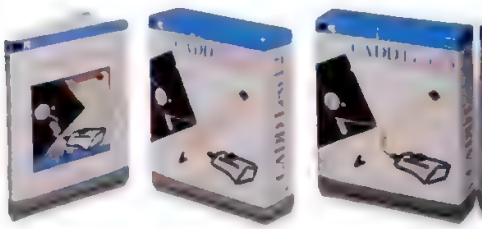

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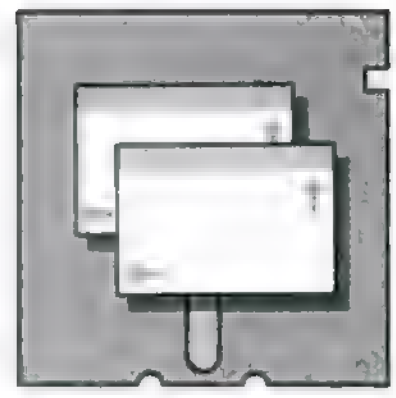
■ ENVIRONMENTS ■ CHARLES PETZOLD

INTRODUCING THE OS/2 PRESENTATION MANAGER



Here's a first look at OS/2 1.1, whose graphics-based interface sets standards for ease of learning and use for the next generation of application programs.

"The time has come," the Walrus said,
"To talk of many things:
Of messages and window procs,
Resources, menus, strings,
And how to use a dialog box
To make your programs sing."

In other words, my friends, the OS/2 Presentation Manager has arrived.

Paraphrasing Lewis Carroll on this occasion is certainly appropriate. The Presentation Manager is a wonderland of new ideas and concepts that, initially, can be disorienting and even a little scary. This is a system with its own architecture, its own vocabulary, its own Weltanschauung.

In this issue's column we'll take our first brave steps through the looking glass into the OS/2 Presentation Manager.

WHAT IT IS The Presentation Manager is part of OS/2 1.1, which is scheduled for retail availability from IBM in October 1988. Other computer manufacturers (such as Compaq and Zenith) are expected to license OS/2 1.1 from Microsoft and adapt it to their own hardware.

As with OS/2 1.0, Microsoft has made a preliminary beta-test version of the operating system available to programmers as part of its $3,000 OS/2 Software Development Kit (SDK). The beta version of the Presentation Manager was originally scheduled for shipment in December 1987 but was not shipped until April 1988. The Presentation Manager program that I'll show in this issue (and those in the next couple of Environments columns) is based on this April beta-test release. Keep in mind that there undoubtedly will be some changes in the Presentation Manager over the next few months that may affect these programs.

The Presentation Manager is a graphics-based multitasking windowing environment that looks and feels much like its DOS counterpart, *Microsoft Windows*, Version 2.0. This type of graphical interface (sometimes also called a "visual interface") incorporates menus, dialog boxes, scroll bars, buttons, and other objects that facilitate user input through the keyboard or a pointing device such as a mouse. The menu and dialog box interface is consistent across applications. Users often find that such an interface is easy to learn and use.

Figure 1 shows a typical Presentation Manager display. (It looks better in color.) The screen serves as a desktop. Each program occupies a rectangular area (called a window) on the desktop. The program is identified by a title bar across the top of the window. To the left of the title bar is a small box that invokes the drop-down sys-

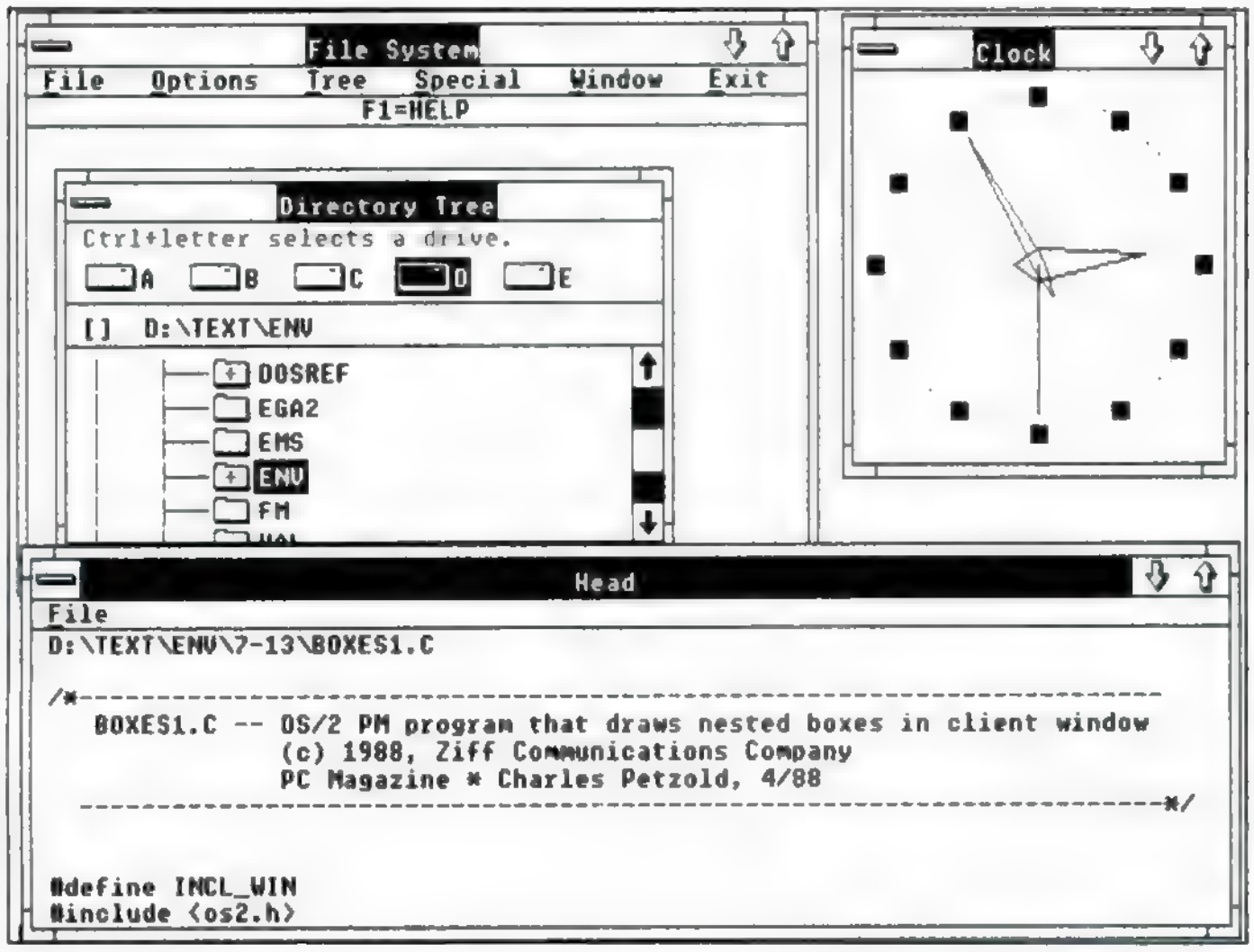


Figure 1: *A typical Presentation Manager display.*

■ ENVIRONMENTS

tem menu. The options on the system menu are generally the same for all applications. To the right of the title bar are two arrows. The arrow pointing up is used to "maximize" the window so that it fills the whole screen. The arrow pointing down is used to "minimize" the window so it occupies a small area at the bottom of the screen. The entire window is surrounded by a sizing border for changing the size of the window.

Below the title bar is the applications main menu (if the program uses a menu). Each option on the main menu invokes a drop-down menu. Some menu items invoke a dialog box, which is a smaller window containing "controls" such as buttons, check boxes, text entry fields, and list boxes.

The Presentation Manager (and programs running under it) occupy one OS/2 session. You can run OS/2 1.0 full-screen applications in other sessions and switch among the sessions. Most OS/2 1.0 applications will also run in a window under the Presentation Manager.

You can think of OS/2 1.1 as supporting two distinct and very different environments. The OS/2 kernel (which is part of both OS/2 1.0 and OS/2 1.1) is mostly for traditional character-mode applications that display output in a teletype fashion or use the full screen. The Presentation Manager is a more modern graphical windowing environment.

WHERE IT CAME FROM Of course, graphical windowing environments are not new. They were first developed in pioneering work done at the Xerox Palo Alto Research Center (PARC) beginning in the mid-1970s with machines known as the Alto and Star.

Windowing environments entered the personal computer arena in January 1983, when Apple Computer introduced the Lisa. The Lisa flopped, but a year later Apple introduced the Macintosh, which has proved to be very successful.

On the DOS and PC front, two graphical windowing environments were released in 1985: *Microsoft Windows* (originally announced by Microsoft in November 1983) and Digital Research's *GEM*. *Windows* was more successful than *GEM* in attracting PC software developers, but *GEM* met with some success on machines other than the PC, such as the Atari ST. Windowing environments have also shown up on other low-end personal computers, such as the Commodore Amiga and the Apple IIGS.

On the higher end of the small computer spectrum, workstations such as those developed by Sun Microsystems also run graphical windowing systems. Sun's major environments are called *SunWindows* and *SunView*. *SunView* runs under Unix on Sun's new 80386-based machine.

In the 1990s the typical computer display will present a graphical windowing environment. All the systems I've mentioned look a little different, yet from a user's perspective they are fundamentally quite similar. You can sit down with an application under any of these environments, use the mouse to explore the menus, and soon begin working.

This is quite surprising—somehow the computer industry has settled upon something like a standard in user interface design. Despite the recent bizarre look-and-feel lawsuit initiated by Apple (whose lawyers apparently believe the graphical interface was invented in Cupertino, California), windows are here to stay.

IBM in particular has big plans for the Presentation Manager. The Presentation Manager forms one of the cornerstones of Systems Application Architecture (SAA), which is an attempt to standardize user interfaces and application program interfaces (APIs) across IBM's entire line of computers. If this comes to pass (and some people feel it is crucial to IBM's long-term survival), the Presentation Manager interface will be a common sight to users of all IBM computers.

HOW DOES IT KNOW? The first time I saw a windowing environment, I was baffled by how it worked. One common demonstration showed how a window could be resized by the user. The strange thing was that some applications would adjust the contents of the window to the new window size. An analog clock would grow or shrink to the largest size the window could accommodate. A window displaying text would use a different right margin for word wrap.

I knew that the logic for resizing the windows was obviously built into the operating system rather than being duplicated by each application. That made a lot of sense to me. But after the window was resized, how did the program know that the window size had changed?

```
/*--------------------------------------------------------------------
   BOXES1.C -- OS/2 PM program that draws nested boxes in client window
               (c) 1988, Ziff Communications Company
               PC Magazine * Charles Petzold, 4/88
   --------------------------------------------------------------------*/

#define INCL_WIN
#include <os2.h>
#include <stddef.h>

#define NUMBOXES  50      /* number of boxes to draw    */
#define INCREMENT 20      /* rotate each 1/20th of side */

MRESULT EXPENTRY ClientWndProc (HWND, USHORT, MPARAM, MPARAM) ;

int main (void)
     {
     static CHAR szClientClass [] = "Boxes1" ;
     HAB         hab ;
     HMQ         hmq ;
     HWND        hwndFrame, hwndClient ;
     QMSG        qmsg ;

     hab = WinInitialize (0) ;
     hmq = WinCreateMsgQueue (hab, 0) ;

     WinRegisterClass (
                    hab,                 /* Anchor block handle             */
                    szClientClass,       /* Name of class being registered  */
                    ClientWndProc,       /* Window procedure for class      */
```

(continues)

Figure 2: *The BOXES1.C program draws a series of nested rectangles in its window.*

```
                    CS_SIZEREDRAW,      /* Class style                    */
                    0) ;                /* Extra bytes to reserve         */

     hwndFrame = WinCreateStdWindow (
                    HWND_DESKTOP,       /* Parent window handle           */
                    WS_VISIBLE          /* Style of frame window          */
                         | FS_SIZEBORDER
                         | FS_TITLEBAR
                         | FS_SYSMENU
                         | FS_MINMAX,
                    szClientClass,      /* Client window class name       */
                    szClientClass,      /* Title bar text                 */
                    0L,                 /* Style of client window         */
                    NULL,               /* Module handle for resources    */
                    0,                  /* ID of resources                */
                    &hwndClient) ;      /* Pointer to client window handle */

     while (WinGetMsg (hab, &qmsg, NULL, 0, 0))
          WinDispatchMsg (hab, &qmsg) ;

     WinDestroyWindow (hwndFrame) ;
     WinDestroyMsgQueue (hmq) ;
     WinTerminate (hab) ;

     return 0 ;
     }

MRESULT EXPENTRY ClientWndProc (HWND hwnd, USHORT msg, MPARAM mp1, MPARAM mp2)
     {
     static SHORT xClient, yClient ;
     HPS          hps;
     POINTL       aptl[5] ;
SHORT        sRep, sSide ;

switch (msg)
     {
     case WM_SIZE:
          xClient = SHORT1FROMMP (mp2) ;
          yClient = SHORT2FROMMP (mp2) ;
          break ;

     case WM_ERASEBACKGROUND:
          return TRUE ;

     case WM_PAINT:
          hps = WinBeginPaint (hwnd, NULL, NULL) ;

          aptl[0].x = aptl[1].x = 0 ;
          aptl[2].x = aptl[3].x = xClient - 1 ;
          aptl[0].y = aptl[3].y = 0 ;
          aptl[1].y = aptl[2].y = yClient - 1 ;

          for (sRep = 0 ; sRep < NUMBOXES ; sRep ++)
               {
               aptl[4] = aptl[0] ;

               GpiMove (hps, aptl) ;
               GpiPolyLine (hps, 4L, aptl + 1) ;

               for (sSide = 0 ; sSide < 4 ; sSide++)
                    {
                    aptl[sSide].x = ((INCREMENT - 1) * aptl[sSide].x +
                                        aptl[sSide + 1].x +
                                             INCREMENT / 2) / INCREMENT ;

                    aptl[sSide].y = ((INCREMENT - 1) * aptl[sSide].y +
                                        aptl[sSide + 1].y +
                                             INCREMENT / 2) / INCREMENT ;
                    }
               }
          WinEndPaint (hps) ;
          break ;

     default:
          return WinDefWindowProc (hwnd, msg, mp1, mp2) ;
     }
return FALSE ;
}
```

(Figure 2 ends)

Think about it. Suppose you're running a DOS spreadsheet program in character mode on an EGA. Suddenly some deviant RAM-resident program calls interrupt 10h in the PC's BIOS to switch to a 43-line mode. Will the spreadsheet program suddenly use 43 lines? Of course not! The program has no way of knowing the video mode has been changed unless it checks the BIOS.

But these windowed programs apparently knew when the window was resized without being involved in the resizing itself. The programs were getting information from the operating system through some mechanism that didn't fit into the framework of any programming language or operating system architecture with which I was familiar.

IT GETS A MESSAGE! It turns out that the question "How does it know?" is an important one. The answer is central to the architecture of windowing environments in general and the Presentation Manager in particular. It's actually quite simple: the Presentation Manager sends a "message" to the application. In this particular example, the message says: "Hey, app, I've just allowed the user to change the size of your window. You might want to take that into account the next time you redraw the window contents."

A Presentation Manager program learns of many external events through messages. Keystrokes are translated into messages; so are mouse events. When a user makes a menu selection, the menu sends a message informing the program of the selection. When the user pushes a button on a dialog box, the button sends a message saying it was pushed. Basically, all that a Presentation Manager program does is receive messages and process them.

Of course, this sounds very strange initially. How can a menu "send a message"? What's really going on? What does that mean in terms of code?

Maybe it's time to look at some code. Figure 2 shows a small Presentation Manager program called BOXES1. Like most Presentation Manager programs, it is written in C. When compiled, BOXES1 displays the series of nested rectangles shown in Figure 3. BOXES1 adjusts their size and

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shape to the window size. Figure 4 shows multiple copies of BOXES1 running under the Presentation Manager, each in a different size of window.

THE HEADER FILES At first glance, BOXES1.C does not even look like a C program. Presentation Manager programs tend to be API-intensive. They use lots of special data types, identifiers, and functions that aren't part of C at all.

Near the top of BOXES1.C is the preprocessor statement

```
#include <os2.h>
```

This statement brings in 12 more C header files besides OS2.H that total about 256K.

The header files include function declarations for all 220 function calls in OS/2 1.0 (functions with the Dos, Vio, Kbd, and Mou prefixes) and for another 520 function calls added by OS/2 1.1.

These 520 new functions calls are mostly for the two major components of OS/2. The first component is devoted to the windowing and user interface functions. (This is the component that was derived largely from *Microsoft Windows* 2.0.) The 250 functions in this component begin with the prefix Win.

The second major component of the Presentation Manager is a device-independent graphics system called the Graphics Programming Interface (GPI). GPI is derived largely from IBM's Graphical Data Display Manager (GDDM) and the 3270 Graphics Control Program (GCP). The 230 GPI functions have the prefix Gpi.

Presentation Manager functions names use mixed upper- and lowercase and are often quite descriptive. OS/2 trivia: The longest OS/2 function name is 30 characters long. There are three functions of this length:

```
GpiDeleteElementsBetweenLabels
GpiQuerySegmentTransformMatrix
GpiQueryViewingTransformMatrix
```

BOXES1.C uses a small fraction of these 740 function calls, specifically the 12 Win functions and 2 Gpi functions shown in Figure 5. I'll describe these 14 functions in more detail below.

The header files also define many new data types and structures. These use uppercase identifiers. Figure 6 shows the Presentation Manager data types used in BOXES1.C.

Some of these new data types are rather simple and self-explanatory. (For example, SHORT is a signed short integer.) But using these data types rather than normal C data types should allow programs to be more easily ported to the 80386 version of OS/2 and also to be ported to versions of the Presentation Manager that run on ma-

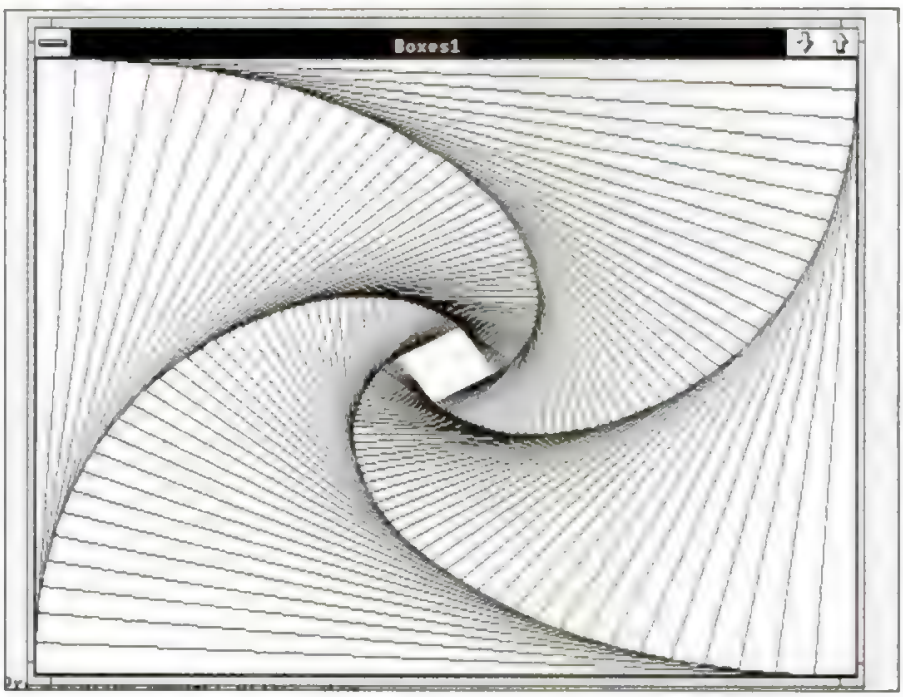

Figure 3: *BOXES1 running under the Presentation Manager.*

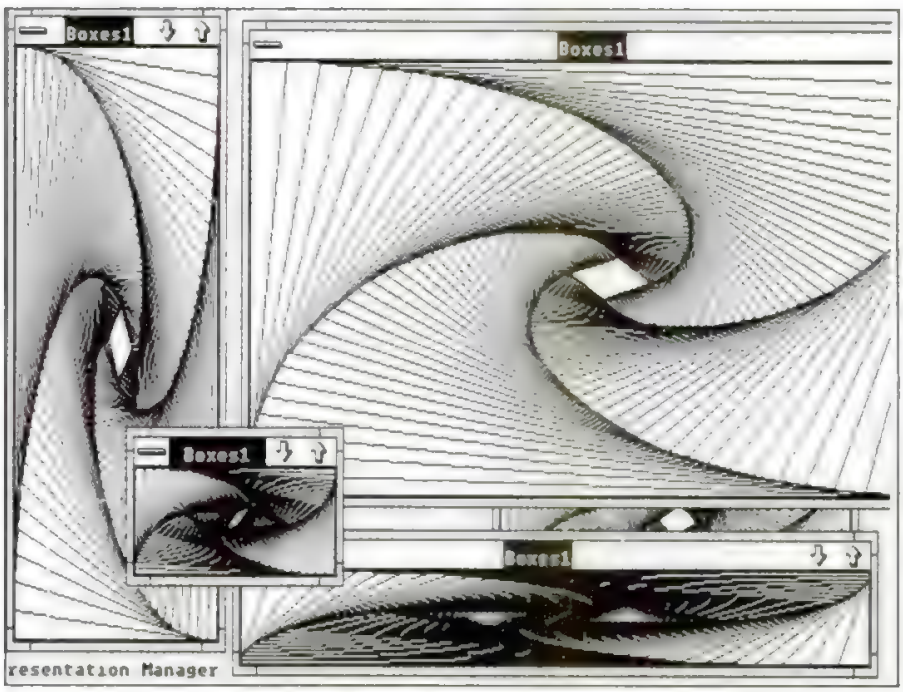

Figure 4: *Multiple copies of BOXES1 running under the Presentation Manager.*

chines other than personal computers.

The header files also define lots of identifiers that lessen the use of numeric constants in your programs. I've counted (not by hand!) about 2,400 #define statements in the 13 OS/2 header files. Those used in BOXES1 are shown in Figure 7.

Most OS/2 identifiers begin with a short prefix (such as FS) that indicates a large group of identifiers ("frame styles"). You aren't required to use these identifiers, of course. For example, you could use the number 35 rather than the identifier WM_PAINT. But which would you prefer to remember?

The header files also define some helpful macros. Two of these macros, SHORT1FROMMP and SHORT2FROMMP, are used in BOXES1.C.

The distinctive "look" of Presentation Manager C code also results from the prevalent use of a variable naming convention called "Hungarian notation" in honor of the legendary Microsoft programmer, Charles Simonyi. Basically, the first few lowercase letters of a variable name identify the type of the variable. SHORT variables are given a prefix of s (for example, sRep and sSide in BOXES1.C); HWND variables are given a prefix of hwnd (such as hwndFrame and hwndClient). Again, you aren't required to use Hungarian notation, but it's a big help in eliminating code errors before they become bugs.

PROGRAM ENTRY POINT As with a normal C program, the entry point to a Presentation Manager program is a function named `main`. The code shown in the `main` function of BOXES1.C is fairly normal. You'll see similar code in virtually every Presentation Manager program.

The WinInitialize function at the beginning of `main` registers the program with the Presentation Manager. You call WinInitialize before calling any other Presentation Manager function. The function returns a number known as an "anchor block handle." This handle uniquely identifies your program. Before the program terminates (at the end of `main` in BOXES1.C), the call to WinTerminate releases the anchor block handle.

The WinCreateMsgQueue function creates a "message queue." The Presentation Manager uses the message queue to store messages for all windows created by the thread that calls the function. The function returns a handle to the message queue. Before the program terminates, it calls WinDestroyMsgQueue to destroy the message queue.

MORE THAN ONE WINDOW The WinCreateStdWindow function creates a standard application window. Until now I've been using the word "window" rather loosely to refer to the area that an application occupies on the screen. Actually,

Presentation Manager Function Calls

Function name	Description
GpiMove	Move current position for subsequent graphics drawing
GpiPolyLine	Draw series of lines starting at current position
WinBeginPaint	Get presentation space handle during WM_PAINT message
WinCreateMsgQueue	Create a message queue
WinCreateStdWindow	Create a standard frame window with child windows
WinDefWindowProc	Default message processing
WinDestroyMsgQueue	Destroy a message queue
WinDestroyWindow	Destroy a window and its children
WinDispatchMsg	Send a message to window procedure
WinEndPaint	Release presentation space handle during WM_PAINT message
WinGetMsg	Get the next message from the message queue
WinInitialize	Initialize Presentation Manager facilities for use by program
WinRegisterClass	Register a window class based on a window procedure
WinTerminate	Release Presentation Manager facilities before program ends

Figure 5: *The Presentation Manager functions used in BOXES1. The function calls used in BOXES1 illustrate the new declarations supporting the two major components of OS/2: the Graphic Programming Interface and the windowing and user interface.*

New Data Types and Structures

Presentation Manager data type	C data type	Description
CHAR	signed char	Signed 8-bit value
EXPENTRY	pascal far	Exported entry point
HAB	void far *	Handle to an anchor block
HMQ	void far *	Handle to a message queue
HPS	void far *	Handle to a presentation space
HWND	void far *	Handle to a window
MPARAM	void far *	Message parameter
MRESULT	void far *	Message result
POINTL		Graphics point structure
QMSG		Queue message structure
SHORT	signed short	Signed 16-bit value
USHORT	unsigned short	Unsigned 16-bit value

Figure 6: *The data types used in BOXES1 and other Presentation Manager programs make these programs easier to port to different versions of OS/2.*

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WinCreateStdWindow creates several windows, and what we think of as a program's main window on the screen really comprises these several windows. A window, as we'll see, is more precisely defined as an object that processes messages.

The title bar is a separate window. The program's menu bar, the system menu box at the left of the title bar, the minimize and maximize arrows to the right of the title bar, and the sizing border are all separate windows. A dialog box is a window. So is every button, scroll bar, and text entry field in the dialog box.

The WinCreateStdWindow function always creates a "frame window," which is the base on which the other windows are assembled. The creation of other windows is governed by the presence of identifiers beginning with FS ("frame style") in the second parameter to the function.

The FS_SIZEBORDER identifier indicates that the Presentation Manager should create a sizing border. This window is the same size as the frame window, but only the outer edges of the window are made visible. The FS_TITLEBAR identifier causes a title bar window to be created. The WinCreateStdWindow parameter described by the comment "title bar text" is the text that appears in the title bar. The FS_SYSMENU identifier directs the Presentation Manager to create a system menu; likewise, the FS_MINMAX identifier causes the creation of the minimize and maximize arrows.

Each of these windows processes keyboard and mouse input in its own unique way. By pressing the mouse button while the mouse pointer is positioned over the title bar, you can move the application's window around the screen. By pressing the mouse button while the pointer is positioned over the sizing border, you can change the window size. The WinCreateStdWindow function also creates an important window—the "client window." This window encompasses the entire area bounded on the left, right, and bottom by the visible part of the sizing border and on the top by the system menu, title bar, and minimize and maximize arrows.

The WinCreateStdWindow returns a handle to the frame window. You use this handle—a unique ID number—to refer to the window in subsequent Presentation Manager functions. In BOXES1.C, this handle is stored in hwndFrame. The function also returns a handle to the client window, which is stored in hwndClient.

Toward the end of `main`, before the program terminates, BOXES1 calls WinDestroyWindow to destroy the frame window. Destroying the frame window also destroys the other windows that were created with the frame window during the WinCreateStdWindow function.

THE MESSAGE LOOP Like all Presentation Manager programs, BOXES1 creates a message queue by calling the WinCreateMsgQueue function. A program must create a message queue before it creates a window. The presence of the message queue is what truly differentiates a Presentation Manager program from an OS/2 kernel program. The message queue is used mostly for storing keyboard and mouse input to all windows created by the program. This code in `main`

```
while (WinGetMsg (hab, &qmsg, NULL, 0, 0))
     WinDispatchMsg (hab, &qmsg) ;
```

is called a "message loop." During the WinGetMsg call the Presentation Manager fills in the fields of the QMSG structure with the next message from the message queue. The WinDispatchMsg function then sends the message to the window to which the message is addressed. The window then processes the message by a function known as the window procedure.

THE WINDOW PROCEDURE Every window has a window procedure (sometimes called the window proc) associated with it. When we say that "a message is sent to a window," we mean that this window procedure is called with parameters that describe the message. When we say that "a window processes a message," we mean that this window procedure interprets the message and acts upon it.

Where are these window procedures? In the case of BOXES1, the window procedures for the frame window, title bar window, sizing border window, system menu window, and minimize/maximize window are located in the Presentation Manager. The window procedure for the client window is located right in the program. It is the function named ClientWndProc ("client window procedure").

How does the Presentation Manager know that the function ClientWndProc is the window procedure for the client window created in the WinCreateStdWindow function? That's the purpose of the WinRegisterClass function. This function reg-

Presentation Manager Identifiers Recognized by OS/2

Identifier	Description
CS_SIZEREDRAW	Class style: Invalidate window when size changes
FALSE	0
FS_MINMAX	Frame style: Include minimize/maximize menu in standard window
FS_SIZEBORDER	Frame style: Include sizing border in standard window
FS_SYSMENU	Frame style: Include system menu in standard window
FS_TITLEBAR	Frame style: Include title bar in standard window
HWND_DESKTOP	Handle to the desktop window occupying the screen background
TRUE	1
WM_ERASEBACKGROUND	Window message: Return TRUE if frame window should paint itself
WM_PAINT	Window message: Update invalid area of the window
WM_SIZE	Window message: The window size has changed
WS_VISIBLE	Window style: Show window after it is created

Figure 7: *The identifiers defined by the header files reduce the numeric constants in OS/2 programs. BOXES1 uses those listed above.*

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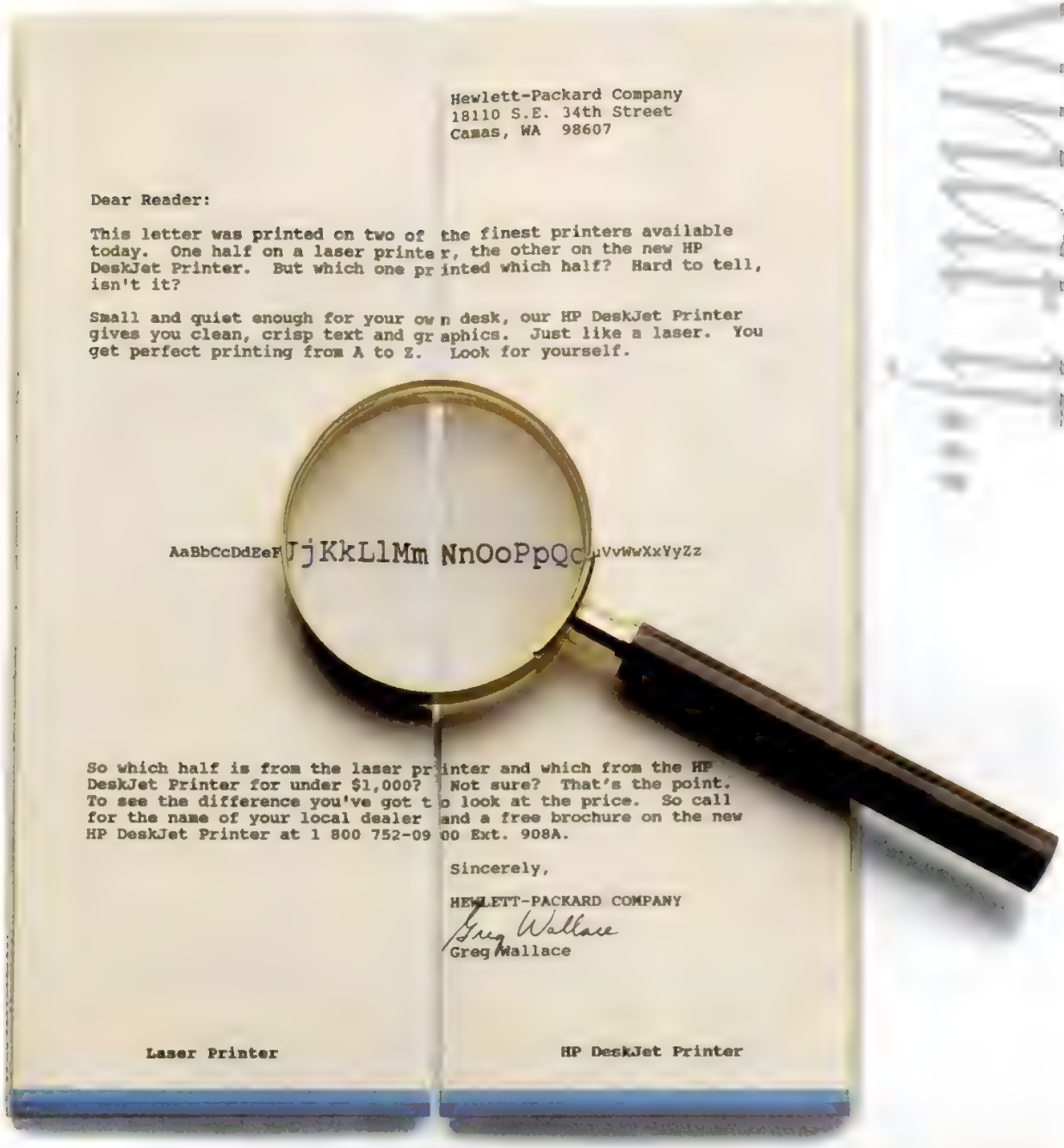

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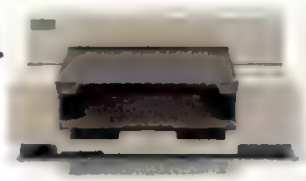

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■ ENVIRONMENTS

isters a window class with the name of "Boxes1." The window class name is then passed as a parameter to the WinCreateStdWindow function. The client window is said to be "based on" this class. All windows based on a particular class are associated with the same window procedure. The window procedure is specified as a parameter of WinRegisterClass.

When discussing the message loop, I said that the Presentation Manager stores messages that represent keyboard and mouse input in the message queue. These messages are retrieved from the queue by calling WinGetMsg and then sent to the appropriate window procedure by calling WinDispatchMsg.

But in other cases the Presentation Manager calls the window procedure directly. This is how the operating system communicates important events to the program—it sends the window a message by calling the window procedure. And this is what is so unusual about Presentation Manager architecture in comparison with traditionally structured operating systems. We're accustomed to calling operating system functions from our programs. But in the Presentation Manager, the operating system calls us!

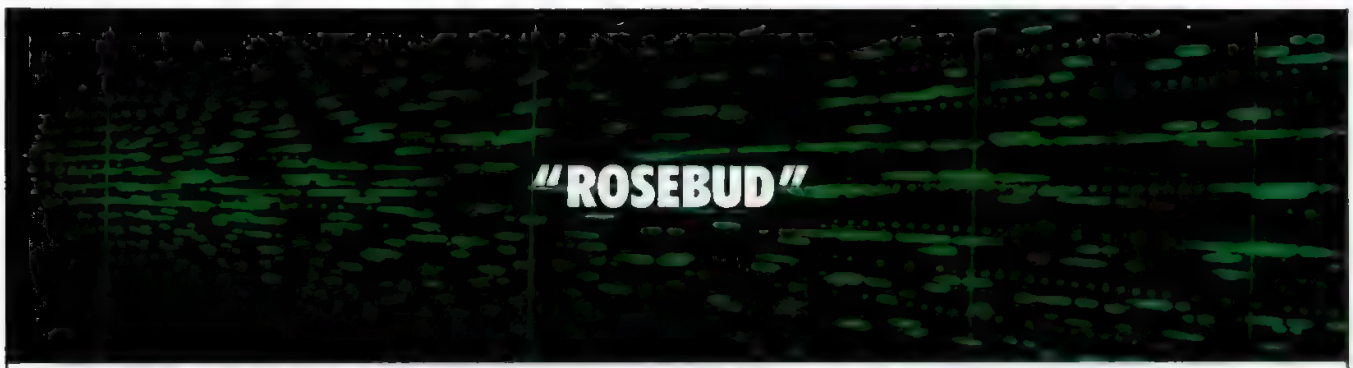
PROCESSING MESSAGES Presentation Manager programs are "message driven." They sit around waiting for messages. Only when a window gets a message does it interpret and process it.

ClientWndProc processes messages sent to the client window. When the Presentation Manager calls a window procedure, it passes four parameters to it. The first parameter (hwnd) is a handle to the window. The second parameter (msg) is a number that identifies the message. The mp1 and mp2 parameters are "message parameters." These provide information specific to the particular message.

A window procedure generally processes messages using a switch statement. The Presentation Manager header files define identifiers beginning with the letters WM ("window message") to determine the message being sent.

In BOXES1, ClientWndProc processes three messages—WM_SIZE, WM_ERASEBACKGROUND, and WM_PAINT. After it processes one of these, the window procedure returns FALSE (0). All messages not processed by a window procedure must be sent back to the Presentation Manager via the WinDefWindowProc function. This function performs default message processing for all messages a window procedure chooses not to process.

You'll recall that we began with the question, "How does a program know when the user has resized its window?" The answer: the Presentation Manager sends the window a WM_SIZE message. That is, the Presentation Manager calls the



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window procedure with the msg parameter set to 7, which is the value that defines the identifier WM_SIZE. The old size of the window (in units of pixels) is encoded in the message parameter mp1. The new size of the window is encoded in mp2.

ClientWndProc processes the WM_SIZE message by extracting the new width and height of the window from mp2 using the SHORT1FROMMP and SHORT2FROMMP macros. The new width is saved in the variable xClient and the height is saved in the variable yClient. These two variables are defined as static because they must be used later while processing subsequent messages.

The first time ClientWndProc receives a WM_SIZE message is during the call to WinCreateStdWindow. The Presentation Manager creates the client window and then informs ClientWndProc of the window size by sending it a WM_SIZE message. ClientWndProc receives other WM_SIZE messages whenever the user changes the size of the window.

PAINTING THE CLIENT One of the most important messages processed by a window procedure is WM_PAINT. It informs the window procedure that the window needs to be repainted. More specifically, the message indicates that an area of the window on the screen has become "invalid" and no longer displays what the program originally put there.

How does part of a window become invalid? This can happen in several ways. When the window is first created, the whole area of the window is invalid and must be painted. When part of a window is moved off the screen, or when one window overlaps another, the Presentation Manager will usually not attempt to save the hidden area of the window. And when that area is moved back into view, it is an invalid area. This causes a WM_PAINT message to be sent to the window procedure so that the window can be updated.

A window procedure also receives a WM_PAINT message when the window changes size. The WM_PAINT message occurs after the WM_SIZE message. Thus, by the time the window procedure begins painting the window, it knows the new window size and can paint based on that size. This is what BOXES1 does.

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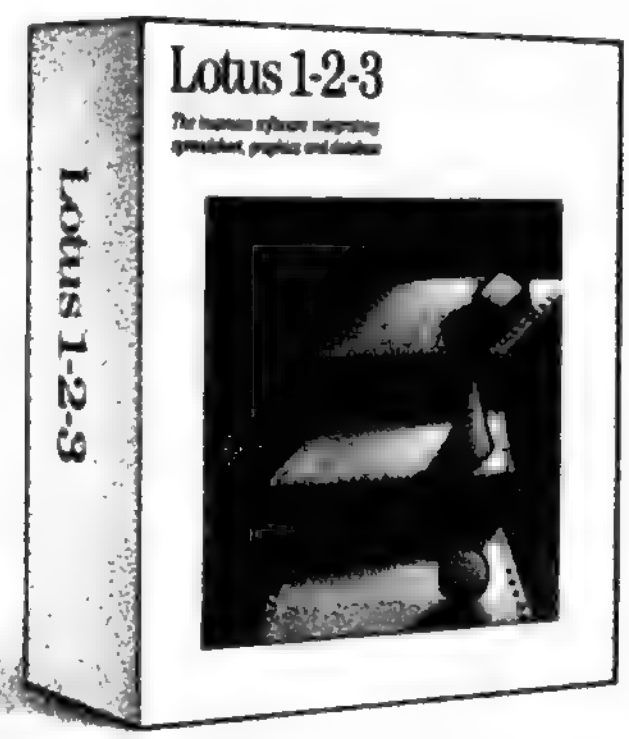

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■ ENVIRONMENTS

PROCESSING WM_PAINT Usually the processing of the WM_PAINT message begins with a call to WinBeginPaint:

```
hps = WinBeginPaint (hwnd, NULL, NULL) ;
```

This function returns a handle to a "presentation space." You need this handle to display anything on the window's surface. The presentation space handle is the first parameter to all the GPI graphics-drawing functions. GPI will clip graphics output on the window's surface—you can't draw outside your window even if you try.

A window procedure wraps up WM_PAINT processing with a call to WinEndPaint:

```
WinEndPaint (hps) ;
```

This has the effect of validating the entire surface of the window.

DRAWING LINES BOXES1 processes the WM_PAINT message by drawing a series of rectangles in its client window. The two functions it uses are GpiMove and GpiPolyLine.

You specify a coordinate point in GPI functions using a POINTL structure. The POINTL structure is defined in an OS/2 header file as follows:

```
typedef struct _POINTL
        {
        LONG x ;
        LONG y ;
        }
        POINTL ;
```

Thus a POINTL structure has two fields, called *x* and *y*, that are signed long (32-bit) integers. By convention, when you define a variable of type POINTL, you give the variable name a prefix of ptl:

```
POINTL ptlLowerLeft ;
```

Again by convention, the variable name for an array of POINTL structures begins with the letters aptl.

By default, the GPI coordinate space has an origin at the lower-left corner of the window. Values of *x* on the horizontal axis increase to the right; values of *y* increase going up. The units are pixels. (You can also use a coordinate system based on inches or millimeters if you wish.)

The GpiMove function does not draw anything. Instead it sets the "current posi-

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tion" to the point indicated by the POINTL parameter to the function. The GpiPolyLine function then draws a series of lines (in BOXES1, four lines) starting from the current position.

ONE WINDOW TO ANOTHER Messages also allow windows to communicate among themselves. In BOXES1 this occurs with the WM_ERASEBACKGROUND message. The frame window sends this message to the client window. The message essentially says, "I (the frame window) have just received a WM_PAINT message. Do you want me to paint my window, thus effectively erasing the background of the client window?"

The client window can respond to this message in one of two ways. If the client window procedure returns FALSE (a zero value), the client window is essentially saying, "No, thanks. I'll erase the background of my window myself." If the window procedure returns TRUE, it's telling the frame window, "Sure. Go ahead."

If the client window does *not* process the WM_ERASEBACKGROUND message, then the message is passed to the WinDefWindowProc function. In response to the WM_ERASEBACKGROUND message, WinDefWindowProc returns FALSE to ClientWndProc and ClientWndProc then returns FALSE to the frame window. The default processing of WM_ERASEBACKGROUND is for the frame window not to color itself when it gets a WM_PAINT message.

TERMINATION We've seen how the structure of BOXES1 allows the program to adjust the contents of its client window based on the size of the window. Whenever the size is changed by a user, ClientWndProc receives a WM_SIZE message followed by the messages WM_ERASEBACKGROUND and WM_PAINT. Whenever part of the window becomes invalid for other reasons, the client window receives WM_ERASEBACKGROUND and WM_PAINT messages and simply recreates what was there before. The program is structured around the processing of these messages.

All other messages to the client window are processed by WinDefWindowProc. One example of how this works is seen during the termination of a program.

A Presentation Manager program can be ended by selecting the Close option from the system menu. The frame window processes the command and then sends a WM_CLOSE message to the client window. If the client window procedure chose to process the WM_CLOSE message, it could ask the user for confirmation if any work had not yet been saved to disk. WinDefWindowProc processes the WM_CLOSE message by placing a WM_QUIT message in the program's message queue.

You'll recall this message loop in main:

```
while (WinGetMsg (hab, &qmsg, NULL, 0, 0))
     WinDispatchMsg (hab, &qmsg) ;
```

For most messages the WinGetMsg function returns a nonzero value. For the WM_QUIT message, however, WinGetMsg returns zero. This causes the loop to end. The program then calls WinDestroyWindow, WinDestroyMsgQueue, and WinTerminate and terminates normally.

TWO MORE FILES Two other files are required for compiling BOXES1. One of these files is the "make file" shown in Figure 8. You compile and link BOXES1 with the command

```
MAKE BOXES1
```

MAKE reads the make file and compares the date and time of the file indicated to the left of the colon (the target file) with the date and time of the file or files to the right of the colon (the source files). If any of the source files have been changed more recently than the target files, MAKE runs the indicated command.

Presentation Manager programs often use MAKE because the compiler switches available are more complex than normal and (as we'll see in the next issue) creating a Presentation Manager program usually requires a few additional steps beyond just compiling and linking the C source code file.

Another file required for Presentation Manager programs is in the "module definition file." The BOXES1.DEF file is shown in Figure 9. This file is read by LINK when linking the program and contains information that LINK needs to construct the .EXE file. Note in particular the EXPORTS statement in BOXES1.DEF—this statement must list all the window procedures in the program.

NEXT STEP: A MENU In the next issue we'll upgrade the program to include a menu and call the program BOXES2. The menu will allow selecting colors for the background and for the lines displayed in the client window.

```
#------------------
# BOXES1 make file
#------------------

boxes1.obj : boxes1.c
     cl -c -G2sw -W3 -Zp boxes1.c

boxes1.exe : boxes1.obj boxes1.def
     link boxes1, /align:16, NUL, os2, boxes1
```

Figure 8: *The BOXES1 make file.*

```
;------------------------------------
; BOXES1.DEF module definition file
;------------------------------------

NAME           BOXES1     WINDOWAPI

DESCRIPTION    'Draws boxes in client window (c) 1988, Ziff Communcations Co.'
PROTMODE
HEAPSIZE       1024
STACKSIZE      8192
EXPORTS        ClientWndProc
```

Figure 9: *The BOXES1.DEF module definition file.*

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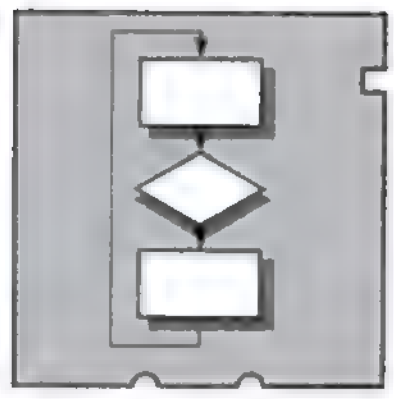

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```
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```

The path can consist of one or more directory names, starting with the disk's root directory and separated by backslash (\) characters. A file specification of this sort, which unambiguously identifies one file out of all the files in the system, is called a *fully qualified filename*.

If you had to enter fully qualified names whenever you wanted to work with a file, your patience would be exhausted in about 5 minutes—especially if you are in the habit of organizing your files in a neat, multilevel tree directory structure. Fortunately, MS-DOS uses the concepts of a "current disk" and a "current directory" for each disk in the system. Whenever you enter a filename that omits the drive specifier or does not include a full path, MS-DOS fills in the missing information according to your current disk and directory.

The ability to use "locality" as an implicit part of a filename is a tremendous convenience from the user's point of view, but it can be a nasty trap for the program-

```
        name    qfn
        title   QFN.ASM --- qualify file name
        page    55,132
;
;
; QFN.ASM -- Qualify File Name
;
; Copyright (C) 1988 Ziff Davis
; by Ray Duncan Feb. 1988
;
; Call with:    DS:SI = filename address
;               AX    = length
;
; Returns:      Carry = clear if filename OK
;               DS:SI = qualified filename
;               AX    = length
;               or
;               Carry = set if bad filename
;
;               Registers other than DS:SI
;               and AX are preserved.
;

DGROUP  group   _DATA

_DATA   segment word public 'DATA'

cdrive  db      0               ; current drive
cpath   db      '\',64 dup (0)  ; current directory

tbuff   db      64 dup (0)      ; target directory

qbuff   db      'X:\'           ; qualified pathname
        db      64 dup (0)

fname   dw      ?               ; filename address
flen    dw      ?               ; filename length

_DATA   ends

_TEXT   segment word public 'CODE'

        assume  cs:_TEXT,ds:DGROUP

        public  qfn             ; make visible to Linker

qfn     proc    near            ; qualify file name

        push    bx              ; save registers
        push    cx
        push    dx
        push    di
        push    es

        mov     flen,ax         ; save length and
        mov     fname,si        ; address of filename

        mov     ax,ds           ; make DGROUP addressable
        mov     es,ax           ; with ES register

                                ; save current drive...
        mov     ah,19h          ; fxn 19h = get drive
        int     21h             ; transfer to MS-DOS
        mov     cdrive,al       ; save it

                                ; save current directory...
                                ; DS:SI = buffer
        mov     si,offset DGROUP:cpath+1
        mov     ah,47h          ; fxn 47h = get directory
        mov     dl,0            ; drive = current
        int     21h             ; transfer to MS-DOS

                                ; did caller specify drive?
```

(continues)

Figure 1: *The source code for QFN.ASM, a subroutine that converts an incomplete file specification into a fully qualified filename.*

■ POWER PROGRAMMING

mer. Suppose, for example, you prompt the user for a filename and he enters

```
myfile.dat
```

Opening the file is no problem: MS-DOS will know that you mean myfile.dat in the current directory of the current drive. Filenames with "relative paths" like

```
d:subdir\myfile.dat
```

or even

```
d:..\subdir\myfile.dat
```

are no trouble either: MS-DOS can still find the file for you.

Suppose, however, that you also provide the user with a way of changing the current directory and/or current drive from within the program. If you store away one of these incomplete filenames for later use and the user subsequently switches to a new drive or directory, your program may not be able to open the file anymore or (worse yet) may open the wrong file.

■ The ability to use "locality" as an implicit part of a filename can be a nasty trap for the programmer.

Obviously then, what we need is a subroutine to convert an incomplete file specification into a fully qualified filename that can be safely used at any time during a program's execution. The QFN.ASM listing in Figure 1 is such a routine.

USING THE QFN ROUTINE QFN is called with the address of a file specification in registers DS:SI and the length in register AX. If the file specification includes a drive code, QFN makes sure that the drive exists. If no drive code is present, QFN adds the identifier for the current drive. Similarly, if a full path is included, QFN makes sure that the path actually exists. If the path is incompletely specified or missing altogether, QFN expands the path using the current directory of the current or specified drive.

If the drive and path components can be successfully resolved to an actual, valid disk and directory in the system, QFN returns the Carry flag cleared (0). The address and length of the fully qualified filename are returned in registers DS:SI and AX, respectively. If the drive or path do not exist, QFN returns the Carry flag set (1). The contents of registers other than DS, SI, and AX are always preserved.

QFN does not make any attempt to determine whether a particular file exists—only whether the specified or implicit location for the file is feasible. Thus, the rou-

```
        mov     di,fname        ; get address of name
        mov     cx,flen         ; get length of name

        cmp     cx,2            ; if drive, length must
                                ; be >= 2 chars.
        jl      qfn2            ; too short, no drive

                                ; check for drive delimiter
        cmp     byte ptr [di+1],':'
        jne     qfn2            ; no delimiter, jump

        mov     dl,[di]         ; get ASCII drive code
        or      dl,20h          ; fold to lower case
        sub     dl,'a'          ; convert it to binary
        mov     ah,0eh          ; fxn 0eh = select drive
        int     21h             ; transfer to MS-DOS

                                ; get current drive to
                                ; make sure drive selected
        mov     ah,19h          ; fxn 19h = get current drive
        int     21h             ; transfer to MS-DOS
        cmp     dl,al           ; current = requested?
        je      qfn1            ; jump if select succeeded
        jmp     qfn8            ; exit, select failed

qfn1:   add     di,2            ; bump pointer past drive
        sub     cx,2            ; and decrement length

qfn2:                           ; save current directory
                                ; again for new drive...
                                ; DS:SI = buffer
        mov     si,offset DGROUP:cpath+1
        mov     ah,47h          ; fxn 47h = get directory
        mov     dl,0            ; drive = current
        int     21h             ; transfer to MS-DOS

                                ; scan off path if any
        push    di              ; save start of path
        mov     al,'\'          ; path delimiter

qfn3:   mov     fname,di        ; save path pointer
        mov     flen,cx         ; save path length
        jcxz    qfn4            ; jump if none left

        repne scasb             ; any '\' left in path?
        je      qfn3            ; loop if '\' found

qfn4:   pop     si              ; recover starting address
                                ; of path portion

                                ; copy path to local buffer
                                ; and make it ASCIIZ...
        mov     di,offset DGROUP:tbuff
        mov     cx,fname        ; calculate path length
        sub     cx,si
        jz      qfn6            ; jump, no path at all
        cmp     cx,1            ; root directory?
        je      qfn5            ; jump if root
        dec     cx              ; else discard last '\'

qfn5:   rep movsb               ; transfer path and
        xor     al,al           ; append null byte
        stosb

                                ; now make target directory
                                ; the current directory...
        mov     dx,offset DGROUP:tbuff
        mov     ah,3bh          ; fxn 3BH = select directory
        int     21h             ; transfer to MS-DOS
        jc      qfn8            ; jump, no such directory

qfn6:                           ; build up full pathname...

        mov     ah,19h          ; get current drive
        int     21h             ; transfer to MS-DOS
        add     al,'A'          ; convert binary to ASCII
        mov     qbuff,al        ; store ASCII drive code

                                ; get current directory
        mov     dl,0            ; DL = 0 for default drive
                                ; DS:SI = buffer address
        mov     si,offset DGROUP:qbuff+3
        mov     ah,47h          ; fxn 47h = get current dir
        int     21h             ; transfer to MS-DOS
        jc      qfn8            ; jump if error

                                ; point to path component
        mov     di,offset DGROUP:qbuff+3
```

(Figure 1 continues)

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```
        cmp     byte ptr [di],0 ; is current directory
                                ; the root directory?
        je      qfn7            ; yes, jump

        xor     al,al           ; scan for null byte at
        mov     cx,-1           ; end of path name
        repne scasb             ; and append backslash
        mov     byte ptr [di-1],'\'

qfn7:                           ; now append filename
                                ; to drive and path...
        mov     si,fname        ; filename address
        cmp     byte ptr [si],'.'
        je      qfn8            ; exit if directory alias
        mov     cx,flen         ; filename length
        rep movsb               ; copy it

                                ; set DS:SI = address
        mov     si,offset DGROUP:qbuff
        mov     ax,di           ; and AX = length of
        sub     ax,si           ; fully qualified filename

        call    makelc          ; fold filename to lower
                                ; case to make it pretty

        clc                     ; Carry = false to
                                ; indicate success

        jmp     qfn9            ; jump to common exit

qfn8:                           ; come here if any
                                ; error detected...

        stc                     ; Carry = true to
                                ; indicate error

qfn9:   pushf                   ; save Carry flag
        push    ax              ; save final length

                                ; restore original directory
        mov     dx,offset DGROUP:cpath
        mov     ah,3bh          ; fxn 3BH = select directory
        int     21h             ; transfer to MS-DOS

        mov     dl,cdrive       ; restore original drive
        mov     ah,0eh          ; fxn 0EH = set drive
        int     21h             ; transfer to MS-DOS

        pop     ax              ; restore length
        popf                    ; and Carry flag

        pop     es              ; restore other affected
        pop     di              ; registers
        pop     dx
        pop     cx
        pop     bx

        ret                     ; back to caller
qfn     endp


makelc  proc    near            ; string -> lower case
                                ; DS:SI = address
                                ; AX = length

        push    bx              ; save BX contents
        xor     bx,bx           ; BX will be pointer
mlc1:                           ; change A-Z to a-z
        cmp     byte ptr [bx+si],'A'
        jb      mlc2
        cmp     byte ptr [bx+si],'Z'
        ja      mlc2
        or      byte ptr [bx+si],20h

mlc2:   inc     bx              ; advance through string
        cmp     bx,ax           ; done with string yet?
        jne     mlc1            ; no, check next char.

        pop     bx              ; restore BX and
        ret                     ; return to caller

makelc  endp

_TEXT   ends

        end
```

(Figure 1 ends)

```
        name    tryqfn
        title   TRYQFN -- QFN demo
        page    55,132

;
; TRYQFN.ASM --- demo of QFN routine
;
; Ray Duncan, February 1988
;

cr      equ     0dh             ; ASCII carriage return
lf      equ     0ah             ; ASCII line feed

stdin   equ     0               ; standard input handle
stdout  equ     1               ; standard output handle
stderr  equ     2               ; standard error handle


DGROUP  group   _DATA

_DATA   segment word public 'DATA'

ibuff   db      80 dup (0)      ; input buffer

msg1    db      cr,lf,lf
        db      'Enter filename:
msg1_len equ $-msg1

msg2    db      cr,lf
        db      'The full pathname is:
msg2_len equ $-msg2

msg3    db      cr,lf
        db      'Bad filename!'
msg3_len equ $-msg3

_DATA   ends


_TEXT   segment word public 'CODE'

        extrn   qfn:near

        assume  cs:_TEXT,ds:DGROUP

main    proc    near

        mov     ax,_DATA        ; make our data segment
        mov     ds,ax           ; addressable...
        mov     es,ax

main1:                          ; display prompt...
                                ; address of message
        mov     dx,offset DGROUP:msg1
        mov     cx,msg1_len     ; length of message
        mov     bx,stdout       ; standard output handle
        mov     ah,40h          ; function 40h = write
        int     21h             ; transfer to MS-DOS

                                ; get a filename...
                                ; address of buffer
        mov     dx,offset DGROUP:ibuff
        mov     cx,64           ; maximum entry length
        mov     bx,stdin        ; standard input handle
        mov     ah,3fh          ; function 3fh = read
        int     21h             ; transfer to MS-DOS
```

(continues)

Figure 2: *The source code for TRYQFN.ASM, a program that demonstrates the QFN routine.*

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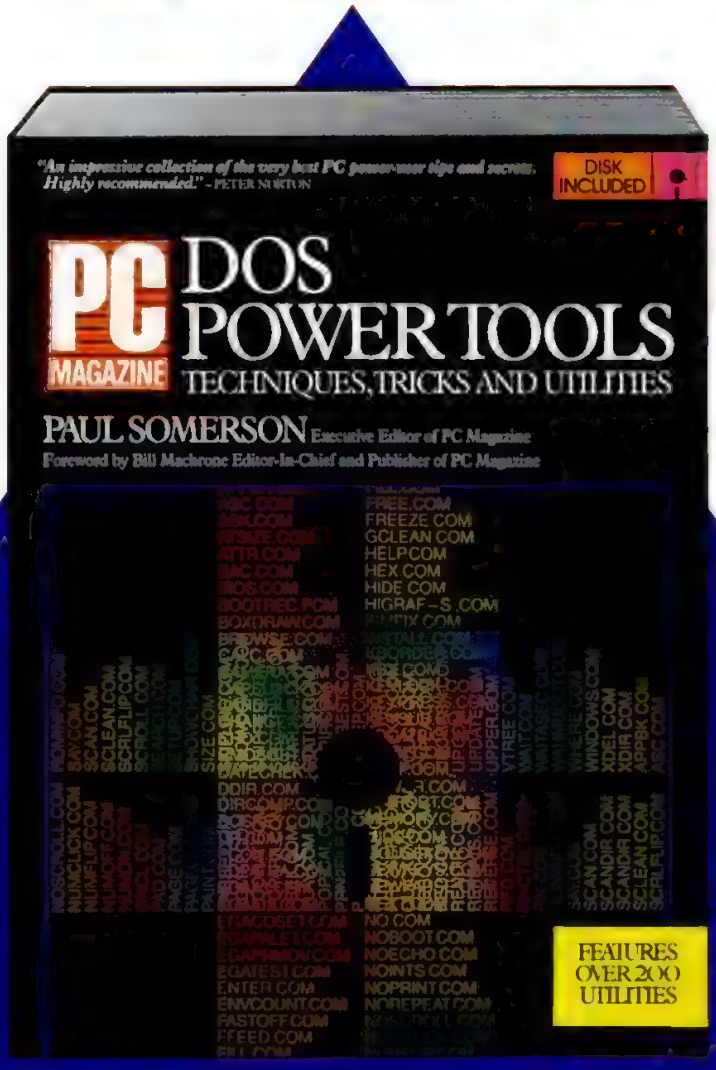

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■ POWER PROGRAMMING

```
        cmp     ax,2            ; anything entered?
        je      main3           ; empty line, exit

                                ; call QFN routine to
                                ; validate and qualify
                                ; the filename...

        sub     ax,2            ; AX = length (decrease
                                ; to remove CR-LF)
                                ; DS:SI = addr of filename
        mov     si,offset DGROUP:ibuff
        call    qfn             ; go qualify filename
        jc      main2           ; jump if bad filename

        push    si              ; save qualified filename
        push    ax              ; address and length

                                ; first display title...
        mov     dx,offset DGROUP:msg2
        mov     cx,msg2_len     ; message length
        mov     bx,stdout       ; standard output handle
        mov     ah,40h          ; function 40h = write
        int     21h             ; transfer to MS-DOS

        pop     cx              ; get filename length
        pop     dx              ; get filename address
        mov     bx,stdout       ; standard output handle
        mov     ah,40h          ; function 40h = write
        int     21h             ; transfer to MS-DOS

        jmp     main1           ; get another filename

main2:                          ; display error message...
                                ; address of message
        mov     dx,offset DGROUP:msg3
        mov     cx,msg3_len     ; length of message
        mov     bx,stdout       ; standard output handle
        mov     ah,40h          ; function 40h = write
        int     21h             ; transfer to MS-DOS
        jmp     main1           ; get another filename

main3:  mov     ax,4c00h        ; terminate with
        int     21h             ; return code = 0

main    endp

_TEXT   ends


STACK   segment para stack 'STACK'

        db      128 dup (?)

STACK   ends

        end     main
```

(Figure 2 ends)

```
C>TRYQFN  <Enter>
Enter filename:           foo.dat  <Enter>
The full pathname is:     c:\word\pc\foo.dat
Enter filename:           c:..\foo.dat  <Enter>
The full pathname is:     c:\word\foo.dat
Enter filename:           c:..\  <Enter>
The full pathname is:     c:\word\          .
Enter filename:  <Enter>
C>
```

Figure 3: *A sample session with the TRYQFN demo program.*

tine can be used to generate fully qualified names of files that are going to be created, or to evaluate drive/path combinations without any filename at all. If you supply QFN with only a drive identifier, it will return the drive and the current path for that drive. If you provide QFN with a partial or relative path terminated by a backslash, it will return a fully qualified drive and path combination.

HOW QFN WORKS The first thing QFN does, after saving the various registers and putting away the address and length of the supplied filename, is to use interrupt 21h functions 19h and 47h to obtain and save the current drive and directory. This is because we're still going to let MS-DOS do the hard work of inspecting the directory structure and evaluating such horrid possibilities as

```
z:dir1\..\dir2\..\myfile.dat
```

Thus, QFN starts by picking off the drive code (if any is supplied) and calls interrupt 21h function 0Eh to select that drive as the current drive. Unfortunately, function 0Eh is the direct equivalent of one of the more brain-damaged CP/M functions: it does not return an error code. The only way to tell whether function 0Eh succeeded is to follow it with a call to function 19h and see whether the drive we asked for actually became the current drive.

Next, QFN extracts the path component by scanning for the last backslash character, copies the path into a local buffer, adds a terminating null byte, and calls interrupt 21h function 3Bh to make it the current directory. We allow MS-DOS the fun of figuring out relative paths (which do not begin with a backslash) and the meaning of any dot (.) or double-dot (..) aliases that the path contains. If the call fails, we know that the path is invalid—some directory named in the path does not exist.

Once we get this far, the rest is simple. We call interrupt 21h functions 19h and 47h to get the current drive and directory, format them together in an ASCII buffer, and append the original filename. We fold the drive code, path, and filename to lowercase characters for visual consistency. Last, we restore the original path and drive and return the address and length of the fully qualified filename to the calling program.

By asking MS-DOS to figure out any complexities in the original path, and then retrieving the cleaned-up path, we've avoided a lengthy and messy coding problem. Of course, there may be MASM connoisseurs out there who will say the code for the QFN routine is lengthy and messy enough as it is. At first glance, there are certainly portions of it that appear redundant or unnecessary. There are three reasons for this:

1. I wanted to supply a routine that would also handle drives and/or partial paths without a filename.

2. I am a strong believer in having a common cleanup and exit point, for the sake of code integrity. Thus, I'm always willing to insert a little extra code elsewhere in order to simplify code at the exit point.

3. A backslash in an MS-DOS path has two totally different meanings, depending on its position. If the backslash occurs at the start of the path, it is the "name" of the

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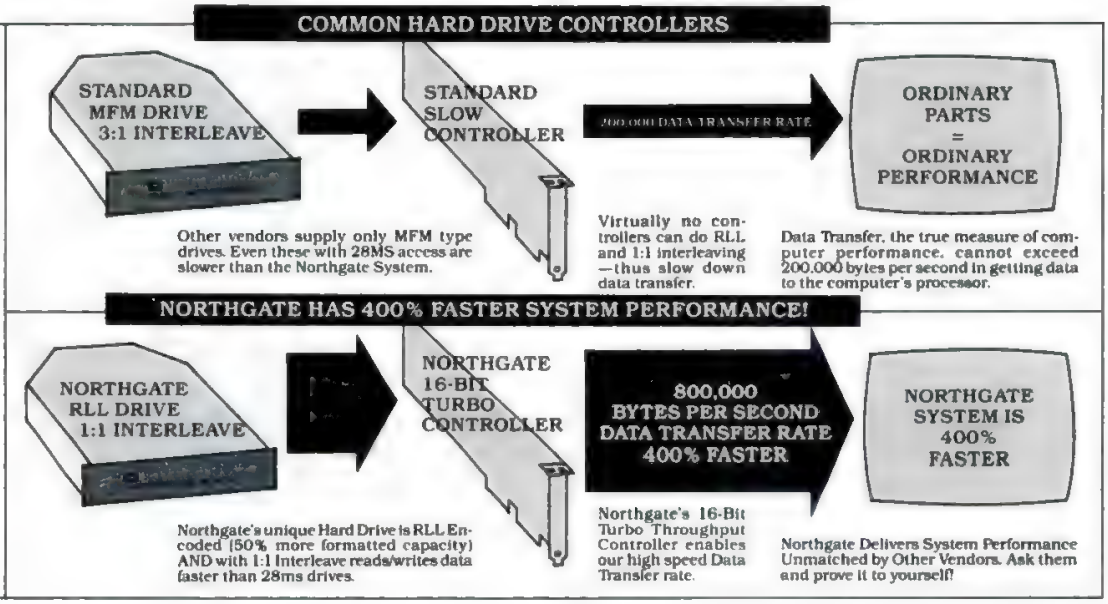

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EXCERPT FROM PC WEEK REVIEW MARCH 8, 1988. USED WITH PERMISSION

Database Add-In for 1-2-3 Has More Capabilities Than Rivals

by Marvin Bryan

The king of the crowded forest of Lotus 1-2-3 database add-ins is unquestionably @BASE...

@BASE was developed by Personics Corp. of Concord, Mass., makers of the popular SeeMORE utilities that add additional columns to the screen displays of Lotus 1-2-3 and Symphony.

With @BASE, it's possible to build colossal 32 M-byte databases in the standard dBASE III Plus format without ever using dBASE itself. Users can convert a normal 1-2-3 database instantly into a dBASE-compatible file, as well as set up dynamic links that will import updated information from dBASE records every time a worksheet is recalculated.

A database can be sorted alphabetically, numerically or chronologically on as many as 128 levels. In fact, @BASE will pack and sort records as much as three times faster than dBASE...

Data can be analyzed with a cross-tabulation module to provide lightning-fast reports in response to such questions as: "What sales people in each division earned more than $20,000 in commissions this month?"

In addition, records can be entered or examined in a form view, where each record occupies an individual screen. Alternatively, of course, the user can choose the usual one-record-to-a-line format.

We tested the current $195 release of @BASE along with a beta copy of the Option Pac, which will retail for $89.95. **Together, these two relatively inexpensive products provide truly remarkable functionality.**

In addition to the indexing feature, the Option Pac will join files to make relational databases, create computed or derived fields, sort a database without rearranging the records on disk, and automatically keep files in the correct sorting order during record entry or updating. See our ad on page 17.

As a bonus, dBASE data can be turned into 1-2-3 graphs with practically no effort at all...

Personics has developed a series of @DB functions to perform calculations and evaluate records within @BASE...Each of these functions use one or more arguments to identify the database, record or field to be acted upon. Some functions allow criteria to be established, such as selecting a subset of records.

The 200-page manual for @BASE is excellent...The program adds less than 80K bytes to the RAM overhead of 1-2-3. **For those who use both dBASE and Lotus 1-2-3, @BASE is practically a requirement.** ■

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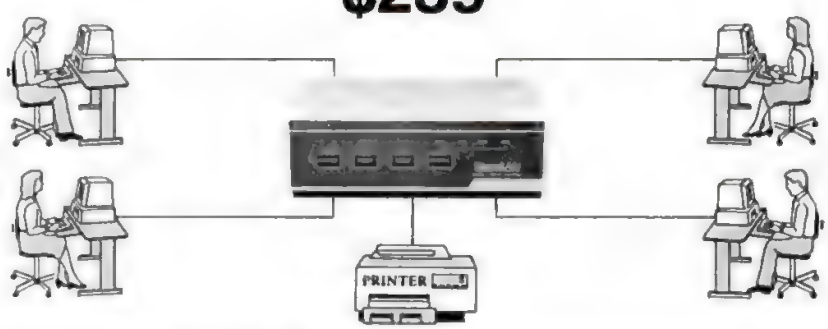

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root directory and is followed immediately by the name of another directory with no intervening delimiter. If it occurs in any other position, it is simply a delimiter that separates two other directory names and has no intrinsic significance at all.

TRYING THE QFN ROUTINE The program TRYQFN.ASM in Figure 2 demonstrates the use of the QFN routine. It prompts the user for a filename, qualifies it with the drive and full path, and displays the result. The demo program may be terminated at any time by pressing the Enter key alone in response to a prompt or by hitting Ctrl-C (^C).

■ The program TRYQFN.ASM demonstrates the use of the QFN routine. It prompts the user for a filename, qualifies it with the drive and full path, and displays the result.

To assemble the files TRYQFN.ASM and QFN.ASM into object modules and then link the modules to create the executable program TRYQFN.EXE, enter the following commands:

```
MASM /Zi TRYQFN;
MASM /Zi QFN;
LINK /CO TRYQFN+QFN;
```

The /Zi and /CO switches can be omitted if you don't want to poke around in QFN's innards with *CodeView*. A sample session using the TRYQFN program is displayed in Figure 3.

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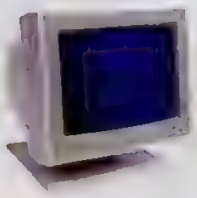

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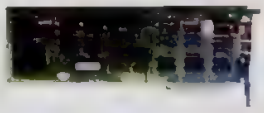

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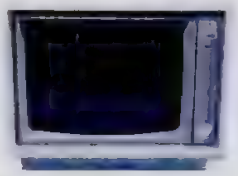

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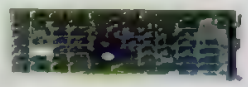

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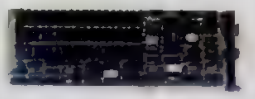

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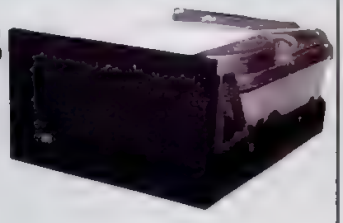

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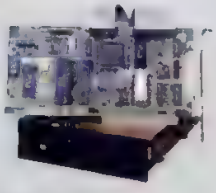

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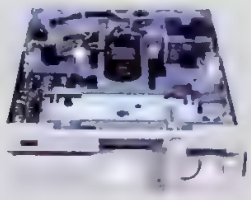

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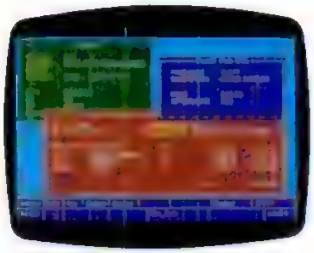

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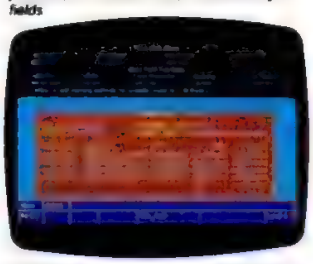

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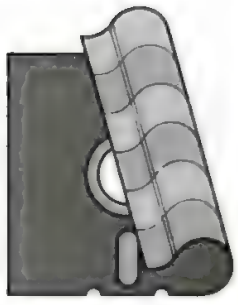
CIRCLE 327 ON READER SERVICE CARD

■ DOUGLAS COBB AND STEVEN COBB

SPREADSHEET CLINIC



Editing records using an undocumented Query key function; calculating grand totals of worksheets with multiple sections; entering an actual monthly calendar series in 1-2-3.

A DATE SERIES MACRO

Because different months have different numbers of days, you can't use *1-2-3*'s /Data Fill command to create a series of dates exactly 1 month apart. Of course, you can enter a monthly date series manually. However, I prefer to use the macro shown in Figure 1.

The first statement in this macro allows you to specify the length of your series, which is stored in the cell MONTHS (B16). The macro then solicits the month, day, and year components of the first date in the series, storing your responses in the cells named MONTH (B14), DAY (B15), and YEAR (B16).

The next statement in the macro enters the serial value of the date described by the values in MONTH, DAY, and YEAR into the cell in which you have positioned the cell pointer. For example, if the cell pointer was on cell A21 when you invoked the macro, *1-2-3* would enter the function

```
@DATE(YEAR,MONTH,DAY)
```

into cell A21. If you specified 1 as the month component, 1 as the day component, and 88 as the year component, this function would return the value 32143—the serial date value of January 1, 1988.

After entering this date, *1-2-3* moves the cell pointer down one cell (to cell A22) and executes the statement in cell B7, which commands it to enter another @DATE function by typing and pointing. This function should return the serial date value of the day exactly 1 month later than the date whose serial value was returned by the function located in the previous cell. Each of the {Up} commands in this statement causes *1-2-3* to point to the previous cell—in this case, cell A21—as it builds the formula.

The +31 portion of the first argument of the @DATE function assures that when the previous date is in December of one year, the function will return a date in the next year. The +31 portion of the second argument of the @DATE function assures that the function will return a value for a date in the next month. The third argument, $DAY, assures that the function will return the value of the same day in each month.

To continue the example, *1-2-3* would enter the function

```
@DATE(@YEAR(A21+31),@MONTH(A21+31),DAY)
```

into cell A22. Since the function in cell A21 returned the value 32143—the serial date value for January 1, 1988—this function would return the value 32174—the serial date value for February 1, 1988.

The next statement in the macro copies

```
        A                       B
1   \d                  {GetNumber "Enter number of months: ",MONTHS}
2                       {GetNumber "Enter intial month (1-12): ",MONTH}
3                       {GetNumber "Enter day of month (1-31): ",DAY}
4                       {GetNumber "Enter intial year (87=1987, etc.): ",YEAR}
5                       '@DATE(YEAR,MONTH,DAY)
6                       {Down}
7                       @DATE(@YEAR({Up}+31),@MONTH({Up}+31),$DAY)~
8                       /c~{Down}.{Down MONTHS-3}~
9                       {Up}
10                      /rfd4{End}{Down}~
11                      /rv{End}{Down}~
12
13  MONTHS
14  MONTH
15  DAY
16  YEAR
```

Figure 1: *This macro enters a series of month-spaced dates into a worksheet column.*

```
(a)     '@IF(@DAY({Up})>3,{Up}+28-@DAY({Up}+28),{Up}+31-@DAY({Up}+31))


(b)     '+@IF(@MONTH({Up})=1,@MIN(@IF(@MOD(@YEAR({Up}),4)=0,29,28),
        @DAY({Up}{Abs})),@IF(@MONTH({Up})=3#OR#@MONTH({Up})=5
        #OR#@MONTH({Up})=8#OR#@MONTH({Up})=10,
        @MIN(30,@DAY({Up}{Abs})),@DAY({Up}{Abs})))~
```

Figure 2: *Two modifications needed by the macro shown in Figure 1 to make it work in all cases. The label shown above as "(a)" replaces that in the original B7. The label shown as "(b)" above goes into a new row inserted between the original rows 7 and 8.*

■ SPREADSHEET CLINIC

the function that *1-2-3* just entered into the remaining cells of the range you wanted to fill. Since the year and month arguments reference the previous cell, the result of each function will be a value in the month after the month represented by the result of the previous function. Since the day component is an absolute reference to the cell named DAY, however, each date value will represent the same day of its month.

The final statements in the macro assign the D4 format to the cells into which it just entered @DATE functions, then replace those functions with their current results.

Jack McKinley
Denver, Colorado

Mr. McKinley's macro works well in most situations. But it will not generate a correct series when you specify the value 31 as the day component of the starting date, nor when you specify a day component of 29 or 30 and the series spans the month of February.

To make this macro work correctly in all cases, you must insert a new row between rows 7 and 8, and replace the entry in cell B7 with the label identified as "(a)" in Figure 2. You must then enter the label identified as "(b)" into cell B8. Together, these labels construct a formula that adjusts properly for the different number of days in each month.

QUERY FIND TRICK

When you issue the /Data Query Find command, *1-2-3* highlights the criterion-matching records, beginning with the matching record closest to the top of the database. (The Cursor Up and Down keys move the highlight to other criterion-matching records.) When you press Enter or Esc, *1-2-3* returns the cell pointer to the cell on which it was positioned when you issued the command.

In many cases, however, I want the cell pointer to stay on one of the highlighted cells when I cancel the /Data Query Find command. It's a nuisance to have to write down the address of the cell and return to it with the {Goto} command—and I've found an easier way.

If you press the Query key (F7) while *1-2-3* is in the FIND mode, *1-2-3* cancels the /Data Query Find command and returns you to the READY mode. Instead of returning the cell pointer to its original cell, the program leaves the cell pointer in the record that was highlighted when you pressed F7. Specifically, it puts the cell pointer on the cell that contains the underline cursor. Unless you pressed the Right or Left Arrow keys while *1-2-3* was in the FIND mode, this will be the leftmost cell of the record.

Unfortunately, *Quattro* does not support this useful behavior of the Query key. Perhaps Borland's programmers weren't aware of this feature, or else thought it was a bug.

Israel Kehaty
Corvallis, Oregon

This previously undocumented function of the Query key was new to us and will benefit many 1-2-3 *users. The feature would be even more useful in* Symphony *than in* 1-2-3, *since* Symphony *does not allow you to edit records while it is in the FIND mode. However,* Symphony *does not have a Query key.*

Fortunately, you can use a macro like that in Figure 3 to duplicate this action of the Query key. You should invoke this macro after issuing the {Menu} Query Find command, using the Cursor Down and Up keys to highlight the record you want, and using the Right and Left Arrow keys to position the underline cursor on the appropriate field of that record.

The first statement in this macro takes the absolute address of the cell in which the underline cursor was positioned when you invoked the macro and enters it into the cell named POSITION (B5). The next statement cancels the {Menu} Query Find command, returning the cell pointer to the cell on which it was positioned before you issued the command. The final statement moves the cell pointer to the cell whose address is stored in POSITION—the cell on which the underline cursor was positioned when you invoked the macro. To understand how this final statement works, see the following submission by Donald Fields.

```
        A                       B
1   \q                  {Let POSITION,@CELLPOINTER("address")}
2                       {Esc}q
3                       {Goto}{POSITION}~
4
5    POSITION
```

Figure 3: *This* Symphony *macro cancels a {Menu} Query Find command and positions the cell pointer on a cell of the last record that was highlighted.*

SAVING A CELL LOCATION

The set of macros presented by John Gufstason (Spreadsheet Clinic, April 12, 1988) that save the current position of the cell pointer works well, but I wish to suggest using a slightly different technique. Rather than enter the address of the current cell into a cell of the "return" macro, I put it into a cell outside the macro and access it with a subroutine call, as shown below in Figure 4.

The statement in the "save" macro enters the absolute address of the current cell into the cell named LOCATION (B3). The first part of the statement in the "return" macro tells *1-2-3* to press the Goto key. While the prompt "Enter address to go to:" is visible at the top of the screen, *1-2-3* reads the second part of the statement, {LOCATION}. This subroutine call tries to execute the commands in the cell named LOCATION.

In this case, the LOCATION cell sim-

```
        A                       B
1    \s                 {Let LOCATION,@CELLPOINTER("address")}
2
3   LOCATION
4
5    \r                 {Goto}{LOCATION}~
```

Figure 4: *This macro uses a subroutine call to access the saved address.*

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CIRCLE 166 ON READER SERVICE CARD

■ SPREADSHEET CLINIC

ply contains the label form of the absolute address of the cell on which the cell pointer was positioned when you invoked the "save" macro. Thus, *1-2-3* types that address to the right of the prompt. Since the cell below LOCATION is blank, the program returns to cell B5 and executes the final part of the statement, ~, which presses Enter. This completes the Goto command, moving the cell pointer to the cell whose address is stored in LOCATION.

Donald Fields
Louisville, Kentucky

The only precaution you must observe in using these macros is to make sure that the cell below the one containing the subroutine is blank or contains the {Return} command.

CALCULATING GRAND TOTALS

Many of my *1-2-3* worksheets are divided into multiple sections, like the one shown in Figure 5. To calculate a "grand total" for these worksheets you can use the simple formula +B7+B13+B20, which adds the results of the @SUM functions in the cells B7, B13, and B20. If you have to add or delete sections of the worksheet, however, you will then have to edit the formula so that it includes the subtotals for the added sections and excludes the subtotals for the deleted sections.

Recently, I've found a better way to calculate a grand total for a worksheet of this sort. Instead of using an addition formula, I now use an @SUM function to calculate the total of the entries in each section plus their subtotals, then divide by 2. For example, to calculate the grand total for the worksheet shown in Figure 5, I'd use the formula `@SUM(B1..B21)/2`. Since the @SUM function includes both the individual values and the sum of those values, its result is exactly double the true grand total. Consequently, dividing by 2 returns the correct answer.

Unlike the simple addition formula, this one does not need to be edited when I add or delete sections from the worksheet.

	A	B
1	SECTION 1	
2	Entry 1a	977.45
3	Entry 1b	888.85
4	Entry 1c	580.96
5	Entry 1d	722.15
6		----------
7	Subtotal 1	3,169.41
8		
9	SECTION 2	
10	Entry 2a	458.85
11	Entry 2b	964.15
12		----------
13	Subtotal 2	1,423.00
14		
15	SECTION 3	
16	Entry 3a	242.51
17	Entry 3b	648.46
18	Entry 3c	269.73
19		----------
20	Subtotal 3	1,160.70
21		
22	GRAND TOTAL	5,753.12
23		

Figure 5: *You can use the formula @SUM(B1..B21)/2 to calculate the grand total for this worksheet.*

■ The @SUM function is a better way to calculate a grand total of a worksheet with multiple sections.

When I insert new sections, *1-2-3* expands the @SUM range to include them; when I delete sections, *1-2-3* contracts the @SUM range. The extra row at the top and at the bottom of the @SUM range assures that *1-2-3* will adjust the formula properly when I add a new section above the first section or below the last one, and when I delete the first or last sections.

Alan Tiet
Los Angeles, California

Mr. Tiet's technique can come in handy in a number of different situations. Note, however, that it will return an incorrect result if, when you make your worksheet changes, you include a section for which you do not calculate a subtotal.

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■ EDITED BY SALVATORE P. RICCIARDI

USER-TO-USER

Automating program development using batch files; using the DOS APPEND command with BASICA; setting a brighter graphics palette.

BRIGHTENING UP GRAPHICS

The default color palette used in medium-resolution color modes creates, on my monitor, a less than appealing display. To correct this, and brighten things up a little, I wrote a small TSR program, INTENSE.COM, that forces the brighter color palette to be used. Interrupt 10h function 0Bh is used to select the color palette used in graphics mode. When loaded, INTENSE intercepts this call and changes the requested palette to include the brighter colors.

```
N INTENSE.COM
A 100
JMP   010F
CMP   AH,0B
JNZ   010A
OR    BL,10
JMP   0000:0000
MOV   AX,3510
INT   21
MOV   [010B],BX
MOV   [010D],ES
MOV   DX,0102
MOV   AX,2510
INT   21
MOV   AH,49
MOV   BX,[002C]
MOV   ES,BX
INT   21
MOV   DX,010F
INT   27

RCX
33
W
Q
```

Figure 1: *The DEBUG script used to create the program INTENSE.COM.*

Dwayne Budzak
Edmonton, Alberta
Canada

The CGA medium-resolution colors are quite murky—it's a mystery why they were chosen as the default. But this small TSR can fix that oversight.

To create INTENSE.COM, type the INTENSE.SCR DEBUG script file (Figure 1) using a pure-ASCII text editor such as WordPerfect's *Program Editor, or the DOS command*

```
COPY CON INTENSE.SCR
```

Be sure to hit the Enter key at the end of each line, especially the last one, and a blank line above RCX. Then, get back to DOS and type

```
DEBUG < INTENSE.SCR
```

to create the executable file.

The program INTENSE should be loaded only once, preferably in your AUTOEXEC.BAT file, before any programs using the medium-resolution graphics mode are run.—Robert L. Hummel

USING APPEND WITH BASICA

I have discovered a problem that occurs when using the DOS 3.3 APPEND command and BASICA. If I have APPEND loaded and execute the demonstration BASIC program shown in Figure 2, the file FILEA.TXT, located in a directory that is included in my APPEND path, will be overwritten by the BASIC program. Although the program should create a new file in the \TMP directory, it doesn't.

```
10 OPEN "\TMP\FILEA.TXT" FOR OUTPUT AS #1
20 PRINT #1, "Creating \TMP\FILEA.TXT"
30 CLOSE
40 SYSTEM
```

Figure 2: *A sample BASIC program that demonstrates a potential problem using APPEND with BASICA.*

If there is no existing file named FILEA.TXT along an APPEND path, then things will work as expected. Otherwise, important data is at risk.

Dave Bartholomew
Oakland, California

The APPEND command carries with it several caveats that users need to be aware of—this is one of them. APPEND loads as a TSR and monitors all DOS file open requests. When a file open request is processed and the file cannot be found, APPEND then steps in and attempts to find a file of the same name in any of the subdirectories in its "path." If it finds one, it substitutes it for the requested file. The calling application never even knows that this has happened.

This substitution, however, can be dangerous in certain situations. The problem lies with the way BASICA determines whether it should try to open an existing file or create a new one. The same BASIC language statement, the "OPEN" statement, is used for both.

When BASICA processes the "OPEN" statement, it uses a two-step approach. First, it assumes that the file exists and at-

■ USER-TO-USER

tempts to open it using the DOS open file handle *function. Then, if the file does not exist, it creates it using the DOS* create file handle *function.*

This process works just fine without APPEND. With APPEND loaded, however, instead of failing because the requested file doesn't exist, the open file handle function can be satisfied by any *file of the same name* anywhere *in the APPEND path. This makes deliberately creating a new file difficult if one with the same name already exists somewhere in the APPEND path—because BASIC will never get to step two of its two-step sequence for opening a file.*

The best solution is to not use the APPEND command. And you don't have to if your application supports subdirectories. APPEND's main purpose is to provide subdirectory access to applications that were written before DOS 2.0. But if you must use APPEND, try the following.

*If the intent is to create a brand-new file, precede the OPEN statement with an OPEN "*filename*" FOR INPUT statement. If this call fails (trap the error using ON ERROR), you can assume the file does not exist in the current directory or in the APPEND path. If the call succeeds, a file with that name exists somewhere in the APPEND path, and caution is needed.*

What if you want to update the file \TMP\FILEA.TXT if it exists, but create it if it doesn't? Unfortunately, with APPEND loaded, there is no way of knowing whether a successful OPEN has opened the requested file or one somewhere in the APPEND path. The BASIC program must take responsibility for retrieving the APPEND path from the DOS environment and searching through it for files of the same name before attempting to open the file. To make this step possible, the APPEND command provides the /E option, which causes the APPEND path to be placed in the DOS environment. From there, it can be retrieved using the BASIC ENVIRON$ command.

The DOS reference manual's explanation of APPEND implies that reading a file, then writing it, may not write the file in the expected directory. It also cautions against using the DOS APPEND command along with the APPEND command from either the IBM PC Network Program, *Version 1.00, or the IBM* PC Local Area Network Program, *Version 1.10. Users of APPEND would be wise to read the DOS manual section on APPEND thoroughly before using it in their applications.*

—Salvatore P. Ricciardi

"SMART" BATCH FILES

Integrated environments are great—they include an editor, a compiler, a linker, and even a make facility. And while many popular languages have this support, there are still some that do not. If you're using one of these (such as MASM or IBM CO-

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CIRCLE 372 ON READER SERVICE CARD

■ USER-TO-USER

BOL/2) or simply prefer another editor, you can still move fairly quickly between the basic components of program development by using "smart" batch files.

For example, after invoking MASM use the following batch file:

```
ECHO OFF
REM SMART.BAT
ECHO %0 %1 > C.BAT
ECHO LINK %1; > L.BAT
ECHO EDIT %1.ASM > E.BAT
MASM %1;
```

You can quickly reedit the source program if necessary by executing the batch file E.BAT, and then recompile by executing C.BAT. After a successful compile, LINK is at your fingertips with L.BAT.

The batch files are created by redirecting the output of ECHO to a drive/directory in your PATH. The batch files are smart in that they remember the program name that you last worked on. The batch file variable "%0" is useful for specifying the name of the batch file being executed. For example, to create a batch file that can be reexecuted quickly, use the command shown in Figure 3.

```
ECHO OFF
REM A BATCH FILE THAT REMEMBERS YOUR LAST COMMAND
ECHO %0 %1 %2 %3 %4 %5 %6 %7 %8 %9 >REDO.BAT
```

Figure 3: *A batch file that remembers your last command.*

Brian E. White
Richmond, Virginia

All programmers find the edit-compile-link process fatiguing. But if you can't—or won't—use an integrated environment, these batch files really help.

To create a batch file that links as well as compiles, add the following line to the end of SMART.BAT.

```
LINK %1;
```

—Salvatore P. Ricciardi

Salvatore P. Ricciardi is a technical editor on the staff of PC Magazine.

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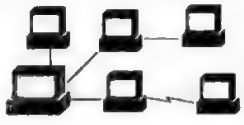

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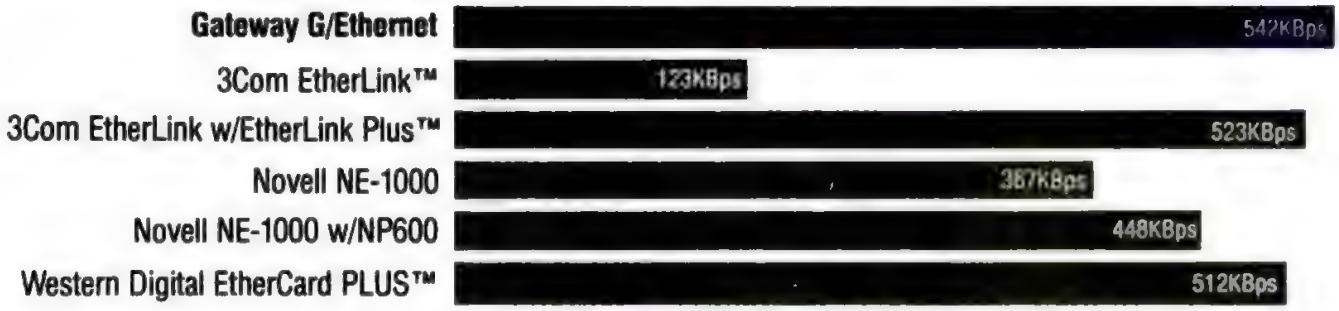

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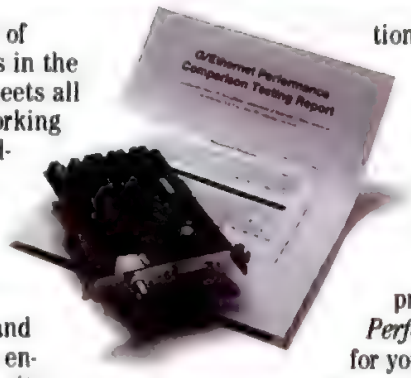

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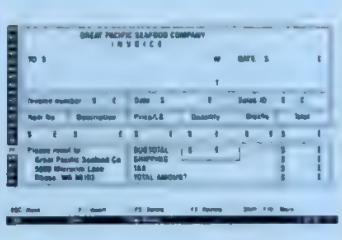

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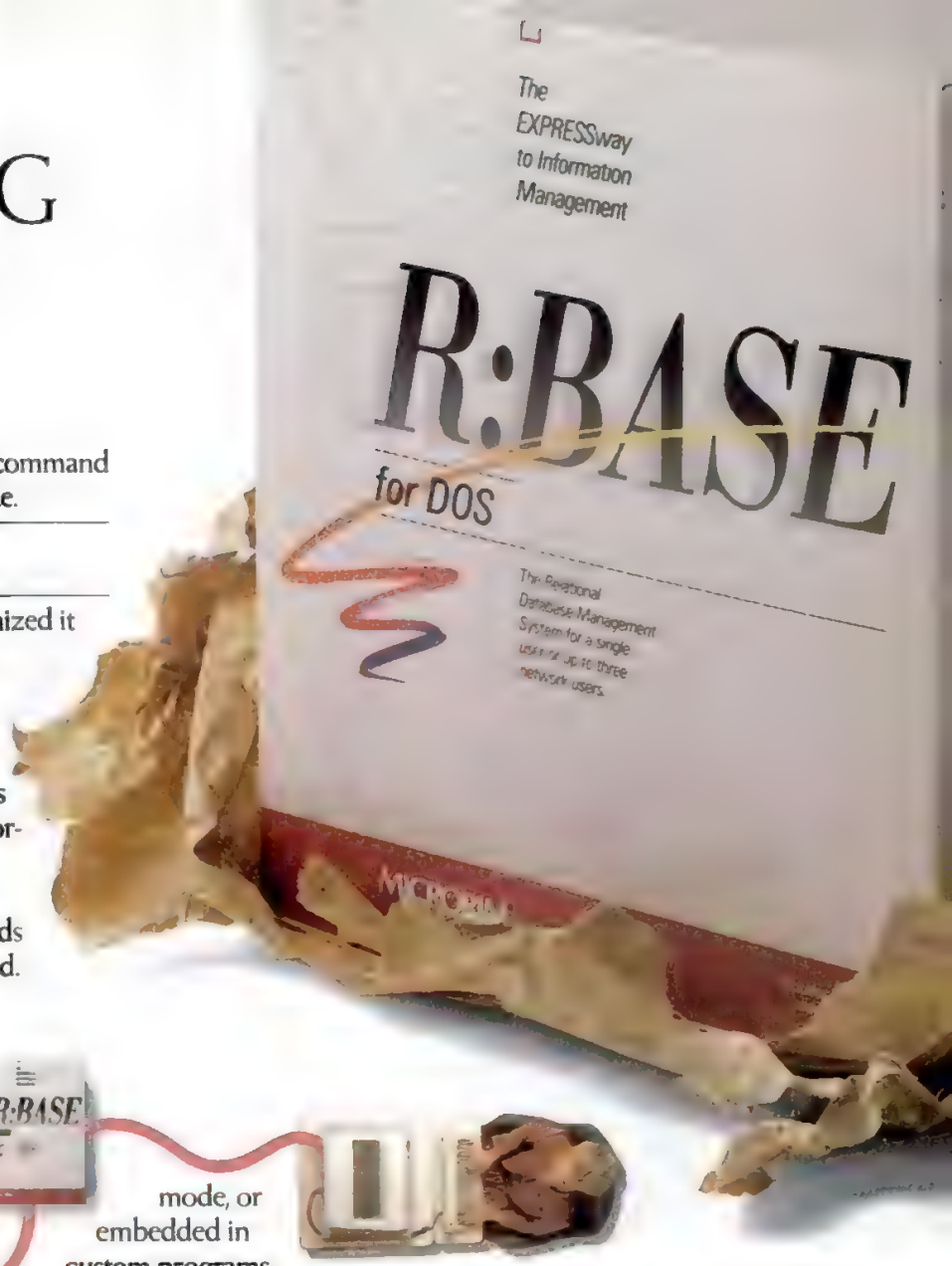

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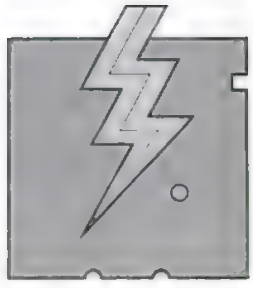

POWER USER

Identifying the current drive and subdirectory in Clipper and dBASE III Plus; creating concordance files in WordPerfect; checking single-word spelling in Microsoft Word.

SPEEDING UP WP

While putting *WordPerfect*'s dictionary and thesaurus on a RAMdisk speeds up their use, the *WP* manual overlooks the speed advantage you can gain by copying WP.EXE and the necessary auxiliary files to the RAMdisk as well. Loading becomes nearly instantaneous, even using WP/R, and more important, moving through long documents is significantly faster.

The copy of *WP* on my RAMdisk requires its own {WP}SYS.FIL, which you must create using *WP*'s setup command (WP/S). I store this new file in the WP directory on my regular hard disk under the name {WP}DSYS.FIL, and I have my AUTOEXEC.BAT rename it {WP}SYS.FIL when copying this and the other needed files to the RAMdisk.

In the setup file, I specify that the automatic backup files reside on the hard disk, since a system crash would destroy them if I put them on the RAMdisk.

Joel Samoff
Palo Alto, California

Readers should note that this plan requires a large *RAMdisk. The overflow files ({WP}.TV1, {WP}.BV1) for large documents can total nearly the size of your work file. If, after all of the* WP *files are copied to the RAMdisk, the remaining disk space is greater than the size of your work file, you should have no trouble.*
—Neil J. Rubenking

CONCORDANCE CONSTRUCTION

When indexing a large document, the concordance feature of *WordPerfect* makes it unnecessary to mark each occurrence of a word manually. Creating the concordance file directly from the primary document is fast and easy with the two macros shown in Figure 1.

To add a word to the concordance file (created as document 2), simply place the cursor on the first letter of the word and press Alt-I. To add text longer than one word, first block the text and then press Alt-Y. The macros automatically append the word or phrase you chose to the end of document 2.

Having these two macros, I can now go through a hard copy of a document and highlight what I want indexed. My secretary simply scrolls through the document and invokes the appropriate macro at the points I marked. I can later edit the concordance file and eliminate duplications by sorting the file.

Nick Dimas
San Antonio, Texas

Do remember to save *the file you create in document 2. You will definitely want to look it over before using it, because it's likely to have a few stray characters. For example, if you choose the last word in a sentence, the period will appear in the*

```
<Ctrl-F10>              Begin macro definition
<Alt-I>                 Attach this macro to Alt-I
<Alt-F4>                Block on
<Ctrl-Right>            Mark the current word
<Left>                  Don't include the space after it
<Ctrl-F4>2              Copy the block
<Shft-F3>               Switch documents
<Home><Home><Down>      Go to the bottom
<Ctrl-F4>5              Retrieve the word
<End><CR>               To end of line, then a carriage return
<Shft-F3>               Back to Doc 1
<Ctrl-F10>              End macro definition

<Ctrl-F10>              Begin macro definition
<Alt-Y>                 Attach this macro to Alt-Y
<Ctrl-F4>2              Copy the block
<Shft-F3>               Switch documents
<Home><Home><Down>      Go to the bottom
<Ctrl-F4>5              Retrieve the word
<End><CR>               To end of line, then a carriage return
<Shft-F3>               Back to Doc 1
<Ctrl-F10>              End macro definition
```

Figure 1: *The two macros used to create a concordance file for words and phrases in* WordPerfect.

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■ POWER USER

concordance file. But the editing is easy, much easier than creating the concordance without help.—Neil J. Rubenking

SINGLE-WORD WORD CHECKING

In the Power User of December 8, 1987, Jim Levitt suggests using *Microsoft Word*'s Library Run command and running WORDFIND to check the spelling of single words. However, if you highlight the word and hit Ctrl-F6, the thesaurus will not only tell you if you misspelled the word but will list words that are similar to it. Also, if you are unsure how to spell a word, you can type as much as you know and hit Ctrl-F6.

Dan Nebres
Everett, Washington

You can indeed use the thesaurus as a quick and dirty spell checker, but it's not really designed with that purpose in mind and will often find a root word when what you really want to know is the right spelling for the suffix. (Is it ignoring *or* ignoreing? *Either one will find* Ignore *in the thesaurus.) I prefer to spell-check the entire document at once, after I've finished writing it. But for those who can't wait, WORDFIND is often the better choice in* Word, *Version 3.1.*

If you decide to upgrade to Word, *Version 4.0 (and you should), you won't find WORDFIND on your disk. Instead, you can check a single word by hitting Alt-F6 to start the spelling checker, then using the new Lookup choice on its main menu. This is still nowhere near as slick as, for example, the spelling checker in* WordStar, *Version 4.0—which will look up words and insert them in the text for you without ever leaving the document—but it's definitely a step in the right direction.*
—M. David Stone

dBASE CALL HOME

dBASE III Plus does not include any built-in function you can use to identify the current DOS drive and directory. Fortunately, however, DOS's interrupts 21h and 47h provide this information directly.

Enter the DEBUG scripts shown in Figures 2 and 3 with any word processor that produces a pure ASCII output. Be sure to end each line with a carriage return, including the blank line after RETF. To create the .BIN files, make sure DEBUG is on the DOS path and issue the following commands:

```
DEBUG < GETDRIVE.SCR
DEBUG < GETDIR.SCR
```

Then, inside your *dBASE III Plus* program, you can CALL for this data with

```
STOR " " TO curdrive,curdir
LOAD getdrive
LOAD getdir
CALL getdrive WITH curdrive
CALL getdir WITH curdir
RELEASE MODULE getdrive,getdir
```

Kevin Owens
Lake Charles, Louisiana

```
N GETDRIVE.BIN
A100
MOV SI,BX
MOV AH,19
INT 21
ADD AL,41
MOV BYTE PTR [BX],AL
INC BX
MOV BYTE PTR [BX],3A
INC BX
MOV BYTE PTR [BX],0
RETF

R CX
13
W
Q
```

Figure 2: *The DEBUG script shown above produces GETDRIVE.BIN, which can be CALLed from* dBASE III Plus *to identify the DOS default drive.*

```
N GETDIR.BIN
A100
MOV SI,BX
MOV DL,0
MOV AH,47
INT 21
RETF

R CX
9
W
Q
```

Figure 3: *A DEBUG script for GETDIR.BIN. LOAD and CALL this binary from* dBASE III Plus *to identify DOS's current directory.*

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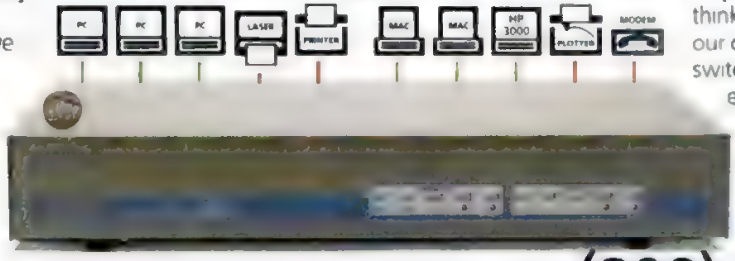

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CIRCLE 328 ON READER SERVICE CARD

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CIRCLE 495 ON READER SERVICE CARD

■ POWER USER

Mr. Owens's excellent utilities are much faster and easier than the programming approach I've used in the past to get this information.

GETDRIVE returns the current drive as a 2-byte string: the drive letter plus a colon. GETDIR returns the current directory without its initial backslash. For example, if your computer is set on a subdirectory called \PC\UTIL, a CALL to GETDIR will return the 7 bytes PC\UTIL. Moreover, if you are on the root directory, GETDIR will return a null string (zero length). So in order to produce the same results as the DOS CD command, you must add the leading backslash, thus:

```
dos_cd=curdrive+"\"+curdir
```

Unfortunately, dBASE *versions before* III Plus *cannot CALL binaries. The programming alternative involves RUNning CD and redirecting its output to a temporary text file; APPENDing this text file into a two-field database; and then STORing the contents of its one record to a pair of memvars.*

Users of Wordtech Systems' DBXL *or* Quicksilver *may use these binaries as is, but* FoxBase Plus, *Version 2.0, employs DOS registers differently, and these routines will not run properly without change. The newest* FoxBase *(Version 2.1) has direct functions to derive both the current drive and the directory.* Clipper *users should see the submission from Sean Stephens that follows.*—Brad Stark

CURRENT DR/SUBDIR IN CLIPPER

Clipper has no function for determining the current drive, and this information can be critical when, for example, the user is logged onto one drive but is executing a program from another, or when he must copy files between two drives.

I use the DOS internal VOL command, *Clipper*'s SAVE SCREEN, and substring-

```
SAVE SCREEN TO o_scr
CLEAR
! VOL
SAVE SCREEN TO n_scr
cur_drv=SUBS(n_scr,AT('d',n_scr)+12,1)
*cur_drv is letter of current drive
REST SCREEN FROM o_scr
RELE n_scr,o_scr
```

Figure 4: *A* Clipper *routine that stores DOS's current drive to a memory variable.*

```
SAVE SCREEN TO o_scr
@ 0,0
RUN cd
SAVE SCREEN TO n_scr
ptr=1
dos_cd=SPAC(0)
DO WHIL SUBS(n_scr,ptr,1)>" "
 dos_cd=dos_cd+SUBS(n_scr,ptr,1)
 ptr=ptr+2
ENDDO
REST SCREEN FROM o_scr
RELE n_scr,o_scr
```

Figure 5: *An alternate routine that finds both drive and subdirectory.*

ing to provide the current drive letter (see Figure 4). *Clipper* saves screens as alternating characters and attribute bytes. I locate the *d* from the word *drive* in VOL's output, then count over 6 letters and 6 attribute bytes to locate the drive letter. This is stored to the memory variable CUR_DRV as the character *A, B, C,* or whatever.

Sean Stephens
Houston, Texas

Usually, you need both *the drive and current subdirectory, so here are a couple of approaches to that end.*

Users of Clipper*'s newest ("Summer '87") version can STORE the current subdirectory directly with this undocumented function built into the program's EXTEND.LIB:*

```
<memvar>=CURDIR("<DriveLetter>")
```

The DriveLetter in this case can be supplied using Mr. Stephens's routine.

Figure 5 is a takeoff on his creative idea, substituting DOS's CD for VOL. This has the advantage of providing both the drive and subdirectory in one step, and it can be used with older versions of Clipper.—Brad Stark

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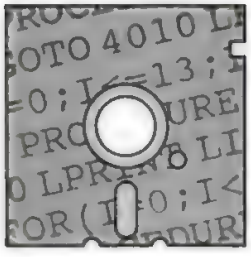
CIRCLE 385 ON READER SERVICE CARD

■ EDITED BY ROBERT L. HUMMEL



LANGUAGES

A simple program to merge C and assembler code listings; creating custom character fonts in BASIC; real-time programming without interrupts in Turbo Pascal.

BASIC

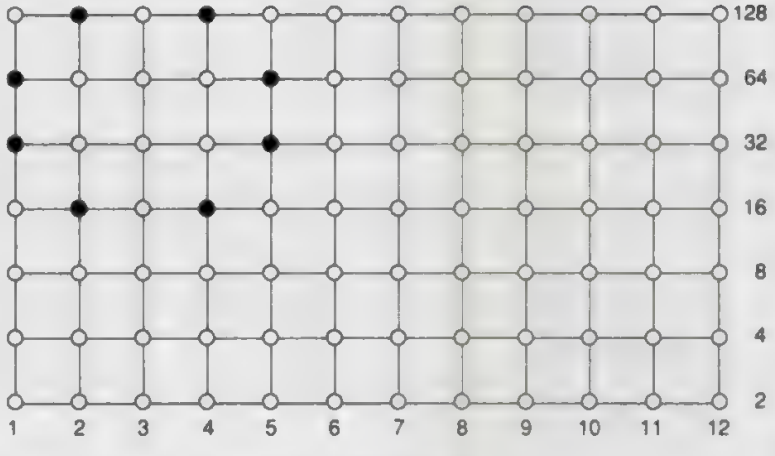
CREATING CUSTOM FONTS

One of the powerful capabilities of the Epson FX series of dot matrix printers is their ability to download and use custom character fonts. These new characters replace those in the existing set. Greek letters or special symbols, for example, may be included in a document.

Custom characters are defined in terms of the printhead pin numbers needed to produce them. The printhead can be visualized by setting up a 12 by 7 grid on a piece of graph paper. The *x*-axis defines the width of the character and is labeled from 1 to 12. On the *y*-axis the scale represents the printer pin numbers in powers of 2 and ranges from 2^1 through 2^7. This is shown in the diagram "Sample Firing Pin Pattern."

When defining your own character set, remember that the same pin cannot be used on two adjacent columns. This would

Sample Pin Firing Pattern



The pin firing pattern for the CHR$(248) degree symbol.

```
10      The following program utilizes the DOWNLOAD CHARACTER
20 '    DEFINITION function of the Epson FX-80 printer and
30 '    adds a new character to the print set.
40 '
50 '
60 '    Reset & copy standard ROM CG into Download CG:
70 '
80 LPRINT CHR$(27); "@"; CHR$(0); CHR$(0);
90 LPRINT CHR$(27); ":"; CHR$(0); CHR$(0); CHR$(0);
100 '
110 '   Download info according to page 3-30, 39 of manual:
120 '
130 '   Character #248 = Degree sign
140 '
150 LPRINT CHR$(27); "&"; CHR$(0); CHR$(248); CHR$(248);
160 LPRINT CHR$(139);
170 LPRINT CHR$(0); CHR$(96); CHR$(144); CHR$(0); CHR$(144); CHR$(96);
180 LPRINT CHR$(0); CHR$(0); CHR$(0); CHR$(0); CHR$(0); CHR$(0);
190 '
200 '   Character #241 = plus/minus
210 '
220 LPRINT CHR$(27); "&"; CHR$(0); CHR$(241); CHR$(241);
230 LPRINT CHR$(139);
240 LPRINT CHR$(0); CHR$(0); CHR$(36); CHR$(0); CHR$(36); CHR$(0);
250 LPRINT CHR$(250); CHR$(0); CHR$(36); CHR$(0); CHR$(36); CHR$(0);
260
270 '   Character #234 = Lower case sigma (partial derivative)
280 '
310 LPRINT CHR$(27); "&"; CHR$(0); CHR$(234); CHR$(234);
320 LPRINT CHR$(139);
330 LPRINT CHR$(0); CHR$(4); CHR$(74); CHR$(144); CHR$(2);
340 LPRINT CHR$(144); CHR$(66); CHR$(60 ; CHR$(0); CHR$(0); CHR$(0);
350 '
360 '   Character #233 = Theta
370 '
400 LPRINT CHR$(27); "&"; CHR$(0); CHR$(233); CHR$(233);
410 LPRINT CHR$(139);
420 LPRINT CHR$(0); CHR$(0); CHR$(24); CHR$(40); CHR$(84); CHR$(130);
430 LPRINT CHR$(16); CHR$(130); CHR$(84); CHR$(40); CHR$(16); CHR$(0);
440 '
450 '   Character #251 = Delta
```

(continues)

Figure 1: *These routines show how to define and download custom characters to an Epson or IBM graphics printer.*

■ LANGUAGES

```
460 '
470 LPRINT CHR$(27); "&"; CHR$(0); CHR$(251); CHR$(251);
480 LPRINT CHR$(139);
510 LPRINT  CHR$(4); CHR$(8); CHR$(28); CHR$(32); CHR$(68);
520 LPRINT CHR$(128); CHR$(68); CHR$(32); CHR$(28); CHR$(8); CHR$(4);CHR$(8)
530 '
540 '   Character #228 = Upper case Sigma
550 '
560 LPRINT CHR$(27); "&"; CHR$(0); CHR$(228); CHR$(228);
590 LPRINT CHR$(139);
600 LPRINT  CHR$(138); CHR$(68); CHR$(138); CHR$(48); CHR$(146);CHR$(0);
610 LPRINT  CHR$(138); CHR$(8); CHR$(198); CHR$(8); CHR$(8);CHR$(8);
630 '
700 LPRINT CHR$(0); CHR$(0);
710 LPRINT CHR$(27); "%"; CHR$(1); CHR$(0);
720 END
```

(Figure 1 ends)

cause jamming of the pins and possibly damage the printhead. The BASIC program listing (Figure 1) shows several examples for downloading custom characters using simple LPRINT commands.

Ron McCormick
Tampa, Florida

After running this program, any of the six new characters that have been defined may be printed by using the appropriate CHR$() values. Additional custom letters and symbols may be defined using the techniques that are described by Mr. McCormick—but there is another method to consider.

Most dot matrix printers allow you to send graphics images directly, which can be done on the fly each time the special symbol is needed. For example, type in the following command string on one line:

```
LPRINT CHR$(27) "L" CHR$(8) CHR$(0) STRING$(4, 144) "---"
```

It will print the CHR$(248) degree symbol, but without adding it to the current set of resident characters.

The CHR$(27) "L" sequence initializes double-density graphics, and the CHR$(8) CHR$(0) pair tells the Epson printer that 8 bytes of graphic data are to follow. (Two bytes are sent to accommodate long graphics strings—hence the use of the first number plus 256 times the second number.) The remaining bytes are the graphics data, which in binary represent the degree symbol. The data follows an organization similar to that used for the downloadable characters.

Note that since the printer is in graphics mode, it will print only as many bits as you tell it to. Therefore, you may need to specify a few extra CHR$(0) bytes to maintain the correct spacing between characters. PC Magazine*'s CALC calculator (Utilities, March 29, 1988) will prove invaluable when converting the various binary bit patterns to decimal CHR$() values.*

With patience (and a thorough reading of your printer's owner's manual), these techniques could be applied to any printer that is capable of loading custom fonts or accepting graphics commands.

—Ethan Winer

TURBO C

MERGING C AND ASM LISTINGS

Sometimes the only way to trace a difficult bug in a C program is to study the machine language instructions generated by the

```
/* merge.c
 * DESCRIPTION: merges a 'c' source file with an asm file
 */

#include <stdio.h>

#define LINEBUFFER 200                  /* length of input line */
#define NAMESIZE 80                     /* DOS file/path length */

FILE *p_to_c, *p_to_asm, *p_to_mer;     /* declare file pointers */
char line_buffer[LINEBUFFER];           /* line buffer */
                                        /* file name buffers */
char file_c[NAMESIZE], file_asm[NAMESIZE], file_mer[NAMESIZE];

main(argc,argv)
int argc;
char *argv[];
{
   int line_count, run_count = 0;

   if (argc != 2)
       help_me();                   /* print the usage message */

   strcpy(file_c,argv[1]);          /* setup the .C filename */
   strcat(file_c,".c");

   if(!(p_to_c = fopen(file_c,"r")))       /* open the .C file */
       file_error(file_c);

   strcpy(file_asm,argv[1]);            /* setup the .ASM filename */
   strcat(file_asm,".asm");

   if(!(p_to_asm = fopen(file_asm,"r")))   /* open the .ASM file */
       file_error(file_asm);

   strcpy(file_mer,argv[1]);            /* setup the .MER filename  */
   strcat(file_mer,".mer");

   if(!(p_to_mer = fopen(file_mer,"w")))   /* open the .MER file */
       file_error(file_mer);

                        /* read each line of the .ASM file */
   while (fgets(line_buffer,LINEBUFFER,p_to_asm) )
   {
       if(strncmp(line_buffer,"; Line",6))/* if "; Line" not found */
       {
           fputs(line_buffer,p_to_mer);    /* write it to merge file */
           continue;                   /* get next line */
       }
                                   /* "; Line" was found */
       line_count = atoi( &line_buffer[7] );   /* generate a line count */
       if(run_count < line_count)      /* if backlog in .c file */
           for( ; run_count < line_count; run_count++)
               write_merge_line();     /* write the lines and catch up */
       else
       {
           write_merge_line();         /* write corresponding c line */
           run_count++;
       }
   }
   fclose(p_to_c);                     /* close all files */
   fclose(p_to_asm);
   fclose(p_to_mer);

}

/* write_merge_line()
 *  reads a line from the C source, and writes it out preceded by
 *  a ';'
 */
write_merge_line()
{
   fgets(line_buffer,LINEBUFFER,p_to_c);   /* get .C file line */
   fputs("; ",p_to_mer);                   /* write ';' to merge file */
   fputs(line_buffer,p_to_mer);            /* put .C line after it */
}

/* help_me
 * DESCRIPTION: prints out the title and usage
 */

help_me()
{
   printf("MERGE: a program to merge a 'c' source file and an ASM file\n");
   printf("USAGE: merge filename \n");
   printf("where filename is the name of the files to merge\n");
   printf("Do not type in the period or extension.\n");
   exit(0);
}

/* file_error
 * DESCRIPTION: prints out error message and name of the
 *              file that could not be opened
 */

file_error(name)
char *name;
{
   printf("MERGE: ERROR IN OPENING FILE: %s \n",name);
   exit(0);
}
```

Figure 2: *MERGE.C is a handy little utility that allows C code to be mingled with the compiler's assembly output.*

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compiler. While Turbo C can generate an assembler listing from a C source file, it can't put the two together in one file. To solve this problem, I wrote a C program, MERGE.C (shown in Figure 2), that creates a single "merged" listing of the original C source code and the compiler's assembler output. The result includes the C code as comments embedded in the assembler source.

To use MERGE, create an assembler listing from your C source code file by using the standalone Turbo C compiler with the -S option. Using the program HELLO.C (see Figure 3) as an example, the command line would be

```
TCC -S HELLO.C
```

This generates the assembler source file, HELLO.ASM. Next, create a merged C and assembler listing, HELLO.MER, as shown in Figure 4, by executing MERGE.

```
MERGE hello
```

Dean Johnson
Oxnard, California

Now, here's a productive use of C! Not only can MERGE aid debugging efforts, but a "merged" listing can be very useful for learning how C is translated into machine language by the compiler.

The limitations of MERGE require that only one .C file at a time be used to generate a merged listing. Since #include references are, of course, only used by the compiler, they will not be listed. Also, since Turbo C will rearrange code for maximum speed or size, the generated assembler may not be in logical order if optimization switches are used.

I took the liberty of modifying MERGE .C slightly to include the globalization of the line buffer, filename buffers, and file pointers (to get them off of the stack); the creation of the write_merge_line() function instead of inline code; and a slight streamlining of the program logic. Micro-

```
#include <stdio.h>
main()
{
        printf("Hello, world\n");
}
```

Figure 3: *The simple "Hello, World" program used to produce a merged listing.*

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* March 10, 1987 issue, page 278

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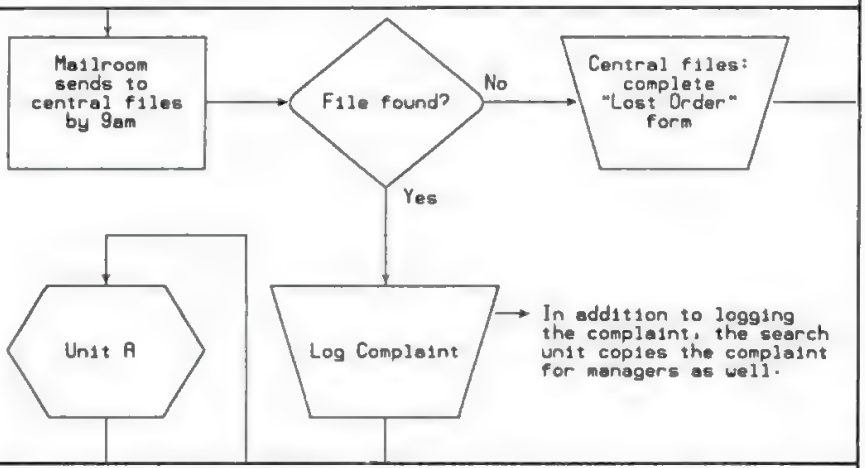

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```
                name    hello
_text   segment byte public 'code'
dgroup  group   _data,_bss
                assume  cs:_text,ds:dgroup,ss:dgroup
_text   ends
_data   segment word public 'data'
_d@             label   byte
_data   ends
_bss            segment word public 'bss'
_b@             label   byte
_bss            ends
_text   segment byte public 'code'
; /*    HELLO.C -- Hello, world */
;
; #include <stdio.h>
;
; main()
; {
_main   proc    near
;       printf("Hello, world\n");
        mov     ax,offset _s@
        push    ax
        call    near ptr _printf
        pop     cx
; }
@1:
        ret
_main   endp
_text   ends
_data   segment word public 'data'
_s@             label   byte
        db      72
        db      101
        db      108
        db      108
        db      111
        db      44
        db      32
        db      119
        db      111
        db      114
        db      108
        db      100
        db      10
        db      0
_data   ends
_text   segment byte public 'code'
        extrn   _printf:near
        public  _main
_text   ends
        end
```

Figure 4: *This merged listing shows the original C code (highlighted) and helps demonstrate what goes on when the HELLO.C program to the left is merged with the compiler's machine language output. Listings of this type can help show what goes on inside a C program.*

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■ LANGUAGES

soft C users can produce a similar merged listing by compiling with the /Fa and /Fs options.—Richard Hale Shaw

TURBO PASCAL

REAL-TIME CLOCK DISPLAY

The program shown in Figure 5 exploits the fact that many programs spend most of their time waiting for keyboard input. If your program follows this pattern, it is very easy to create a real-time clock display without having to patch the BIOS clock interrupt vectors. Naturally, a program that is heavily bound up in non-keyboard tasks cannot use this technique.

To make use of the program's idle time,

■ It's easy to create a real-time clock display without patching the BIOS clock interrupt vectors.

I created a function called KeyInCoprocess. This function constantly checks for a pressed key. If no key is pressed, it calls the coprocess, in this case the Clock routine. When the user presses a key, the loop ends and KeyInCoprocess returns the key as the function result. Actually, you could call a different coprocess from this routine—for example, print spooling or spreadsheet recalculation. The only limitation is that the coprocess must be liberally sprinkled with "IF KeyPressed THEN EXIT" statements, to prevent long waits at the keyboard. [*The coprocess would also require a method for returning to the exact location and state from which the EXIT occurred.—NJR*]

You now must throw out the normal Pascal Read procedure and instead use a procedure called NewRead. The main difference between the two is that NewRead gets characters from the keyboard using

```
PROGRAM Coprocessor_Clock;
  {$V-,C-}  (NOTE These two compiler switches are ESSENTIAL\)
TYPE
  AnyString = STRING[255];

VAR
  PresentColor,
  PresentBackGround : Byte;       (global variables for colour control)
  Hour, Min, Sec    : Byte;       (global variables for clock control)
  TheString         : AnyString;
  Count             : Byte;       (global variables for main program)

  PROCEDURE SetColor(F, B : Byte);
  BEGIN
    PresentColor := F;            (remember the colour settings)
    PresentBackGround := B;
    TextColor(F);                 (and implement them)
    TextBackground(B);
  END;

  PROCEDURE Clock;                ( clock display )
  TYPE
    RegPack = RECORD
                CASE Integer OF
                  1 : (AX, BX, CX, DX, BP, SI, DI, DS, ES, Flags : Integer);
                  2 : (AL, AH, BL, BH, CL, CH, DL, DH : Byte);
              END;
  VAR
    ColumnHold, RowHold, ColorHold, BackGrndHold : Byte;
    Tmp : STRING[2];
    Time : STRING[8];
    Regs : RegPack;

  BEGIN
    WITH Regs DO
      BEGIN                       (get time from msdos)
        AH := $2C;                (call the clock interrupt)
        MsDos(Regs);
        (did the time change ? )
        IF (CH <> Hour) OR (CL <> Min) OR (DH <> Sec) THEN
        (delete the (DH <> Sec) if you don't want seconds display)
          BEGIN
            Hour := CH;           (save the new time)
            Min := CL;
            Sec := DH;            (delete if you dont want seconds display)
            RowHold := WhereY; (save the present cursor position)
            ColumnHold := WhereX;
            ColorHold := PresentColor; (save the present colour)
            BackGrndHold := PresentBackGround;
            Str(Hour:2, Tmp);
            Time := Tmp;
            Str(Min:2, Tmp);
            Time := Time+':'+Tmp;
            Str(Sec:2, Tmp);  (delete if you dont want seconds display)
            Time := Time+':'+Tmp; (delete if you dont want seconds display)
            GoToXY(70, 1);    (go and display the time)
            SetColor(LightCyan, Black);
            Write(Time);
            GoToXY(ColumnHold, RowHold); (restore the cursor position)
            SetColor(ColorHold, BackGrndHold); (and the colour)
          END;
      END;
  END;

  FUNCTION KeyInCoprocess : Char;
    ( get characters from the keyboard )
  VAR
    KeyToGet : Char;
  BEGIN                           (if no key pressed then do something else)
    WHILE NOT KeyPressed DO Clock; (it does not have to be just the clock)
    Read(Kbd, KeyToGet);
    KeyInCoprocess := KeyToGet;
  END;

  PROCEDURE NewRead(VAR StringToGet : AnyString);
  (This procedure replaces the 'Read' procedure to read a string.  It would
   require modification if you want to input integers or reals directly.)
  VAR
    CharacterIn, Discard : Char;
  CONST
    Return = ^M;
    BackSpace = ^H;
    Space = ' ';
    Escape = ^[;
    Beep = ^G;

  BEGIN
    StringToGet := '';            (clear the string)
    REPEAT
      CharacterIn := KeyInCoprocess; (get a key if one is ready)
      CASE CharacterIn OF         (check what sort of key)
        ' '..'~' : BEGIN ('Normal' character. - you can select any
                          acceptable range of characters here)
                     Write(CharacterIn); (write it)
                     StringToGet := StringToGet+CharacterIn;
                     (append it to the string)
                   END;
        BackSpace : IF StringToGet[0] > 00 THEN
                      BEGIN
                        StringToGet[0] := Pred(StringToGet[0]);
                        (remove the last character from the string)
                        Write(BackSpace); (backspace on the screen)
                        Write(Space);     (write a blank)
                        Write(BackSpace); (and backspace again)
                      END;
        Escape : BEGIN
                   IF KeyPressed THEN Discard := KeyInCoprocess;
                   (you could implement something with the cursor
                    or function keys here.)
                 END;
        Return : ;    (don't do anything)
      ELSE Write(Beep);           (tells you if you typed something odd)
      END;
    UNTIL (CharacterIn = Return) OR (StringToGet[0] = #255);
    (repeat until return is typed or the string overflows)
  END;

BEGIN                             (main program)
  SetColor(Red, White);
  ClrScr;
  GoToXY(70, 2);  Write('+---+--+');
  FOR Count := 3 TO 9 DO
    BEGIN
      GoToXY(74, Count);  Write('|');
    END;
  GoToXY(29, 10);  Write('Testing Clock Routine ----------------------+');
  GoToXY(20, 15);  Write('Take about a minute to enter this message');
  GoToXY(25, 16);  Write('and watch the clock being updated.');
  GoToXY(1, 12);   SetColor(Black, White);
  Write('+----------------------------- Input a String');
  Write(' ------------------------------+');
  GoToXY(1, 13);  SetColor(Yellow, White);
  NewRead(TheString);
  GoToXY(1, 20);  SetColor(Black, Magenta);
  Write('+----------------------------- The String Was');
  Write(' ------------------------------+');
  GoToXY(1, 21);     SetColor(Black, White);
  Write(TheString);  GotoXY(1,24);
END.
```

Figure 5: *A real-time clock display that does not modify the clock interrupt. To convert this program, written in Turbo Pascal, Version 3.0, to Version 4.0, use the compiler's UPGRADE.EXE utility with the /3 option.*

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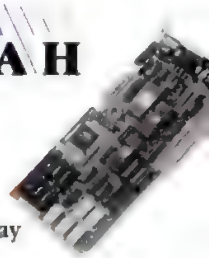

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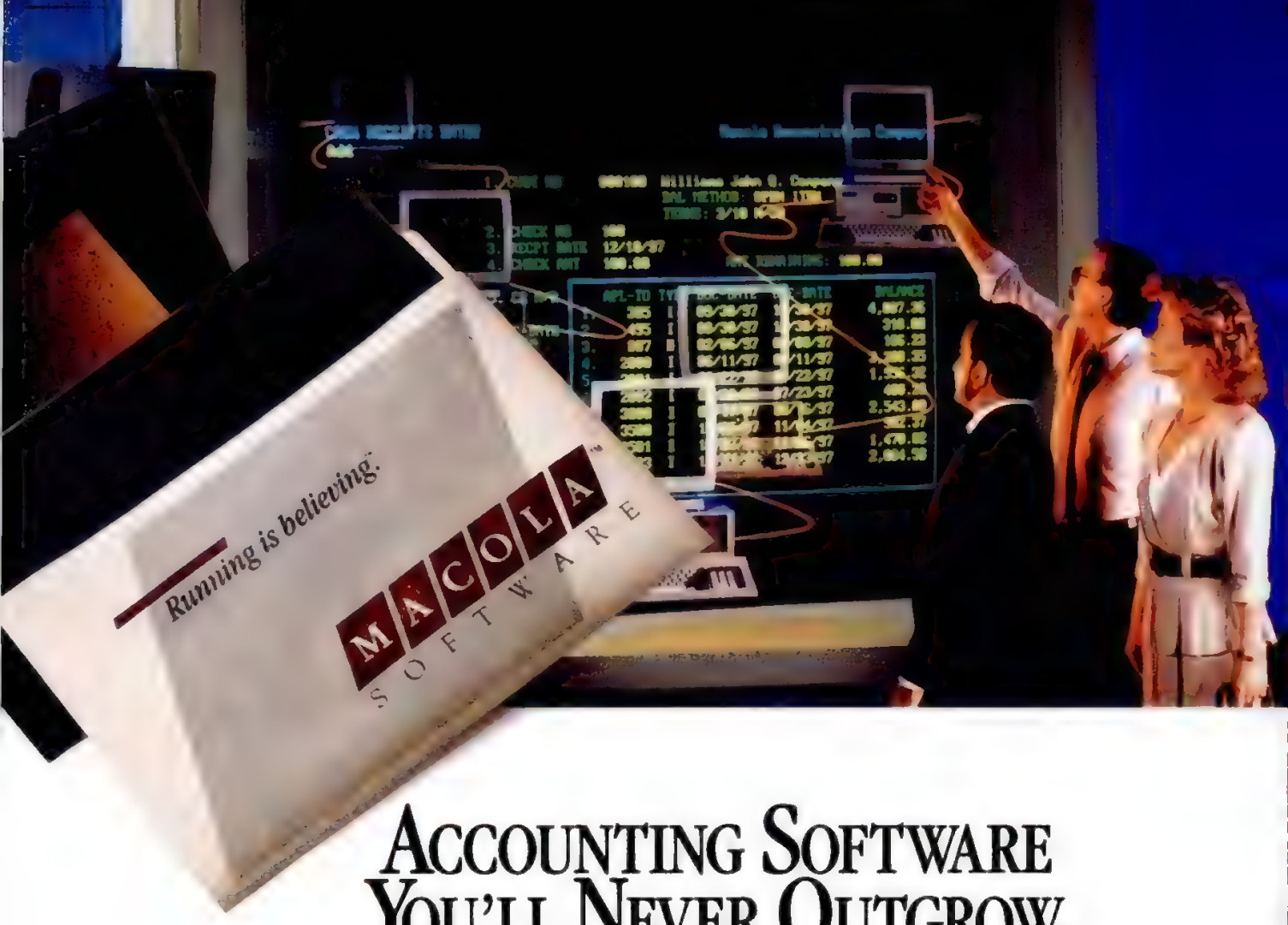

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■ LANGUAGES

KeyInCoprocess and then writes the characters to the screen using the Write procedure. Now, whenever your program is gathering information from the keyboard, the clock will tick away in the upper-right corner of the screen. The Clock procedure shown here updates the time every second. If this continual updating drives you scatty, then you can delete a few lines and just display changes every minute.

The sample program in Figure 5 also includes a procedure called SetColor, which I find simplifies the manipulation of screen colors. It is particularly useful here because the Clock procedure has to write in a certain place and color without losing the previous place and color.

Andrew Fiddian-Green
Singapore

There have been a number of real-time clock programs submitted for this column. The coprocessing technique shown here is certainly safer than modifying the clock interrupt. It may be useful in a program such as a word processor, where in fact most of the time the program is waiting for further user input.

One limitation is the requirement that all Reads go through the NewRead procedure. This procedure accepts a single parameter of a string type. In order to simulate reading multiple items or nonstring variables, you will have to read a single string first and then parse it or convert it to another variable type.

Readers familiar with user-defined I/O drivers may wonder why I don't suggest simply replacing the standard ConIn routine with one that calls a coprocess while it's waiting. Unfortunately, calling such a process from within the ConIn routine creates many of the same problems found in the original interrupt-driven clock procedure.—Neil J. Rubenking

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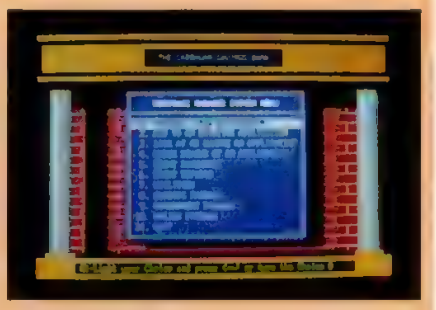

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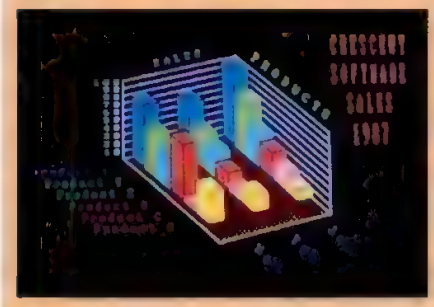

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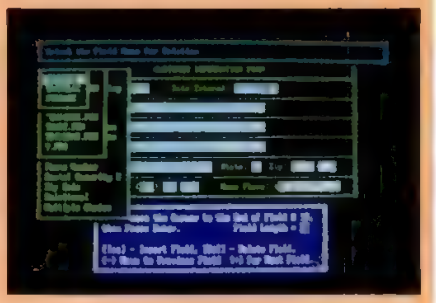

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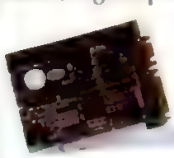

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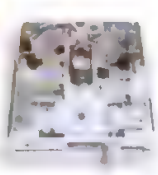

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■ ROBERT L. HUMMEL

PC TUTOR

Two easy patches that improve REMOVE.COM; the truth about bad sectors on hard disks; the genealogy of the parity flag; and DOS's poor dual-display support.

BAD SECTORS ON HARD DISKS

My department has four brand-new IBM PS/2 Model 50s, each equipped with an IBM 20MB hard disk. CHKDSK shows that all four have a number of bad sectors ranging from 20K to 100K.

My contact at the local ComputerLand (who set up our systems) says that IBM considers a drive "good" even if 10 percent of its sectors are bad. An associate of mine asked his service representative about the problem and was told that as long as the balance of usable bytes on the hard disk was at least 20MB, the customer got what he paid for.

We also have an XT clone in the office. CHKDSK reports no bad sectors on this disk. What problems will we experience with the PS/2s and their bad sectors?

Ernest J. Mascarello
Omaha, Nebraska

A hard disk is really a collection of oxide-coated disks, called platters. All data will eventually be stored on the surfaces of these platters, so the quality and consistency of the oxide coating go a long way toward determining the reliability of the drive as a whole. The coatings are never perfect, however. The platter manufacturing process may produce thin spots, thick spots, or even bubbles.

When the hard disk drive is assembled at the factory, it is put through a rigorous test program. These testing procedures represent the manufacturer's best attempt to ensure that all the recording surfaces will be able to be reliably written and read over the life of the disk. Because of variance in the manufacturing tolerances, some areas of the platter surfaces may fail this testing.

THE BAD TRACK LIST *The areas that fail this test are uniquely located to a single track by specifying their head (surface) number, cylinder number, error size, and distance around the cylinder from an arbitrary index. (These two latter parameters are often termed BL and BCAI, or* bit length *and* bit count after index.*) Unfortunately, if any spot on the track is found bad, the entire track is abandoned.*

All the errors detected in the hard disk are printed out by the manufacturer either on a label that is then affixed to the hard disk or as part of a quality control report that is shipped along with it. Some companies that sell complete computers thoughtfully remove this information, along with manuals and setup disks, before shipping to customers. This is based on their belief that what you don't know won't hurt you. But there is a good reason why the original manufacturer provided this "bad track" information.

■ Some companies that sell computers remove bad sector information. This is based on their belief that what you don't know won't hurt you.

PHYSICAL FORMAT *After a hard disk has been installed in a computer system, the next step in preparing a disk drive is to do a low-level, or physical, format. If you think of a newly manufactured disk as a blank piece of paper, then performing a physical format on the disk is analogous to drawing lines on the paper: it creates a structure capable of holding information.*

Most programs that perform a physical format allow the bad tracks listed on the manufacturer's report to be entered before the format is performed. These tracks are then excluded in their entirety *from the initialization during the physical format. This occurs even if only a single bit on the whole track caused the error.*

If these bad tracks are not "forced," by entering the head and cylinder number, the physical format program will attempt to initialize them. If it detects the error, it will force the track as bad anyway. But often the low-level-formatting program succeeds at initializing a track that the manufacturer marked as bad. This may be because the error was a soft error *that might show up only in the long term. The consequences of this will not be immediately obvious.*

LOGICAL FORMAT *When the physical format is complete, a logical format (also known as a* high-level *format) is performed. The logical formatter normally*

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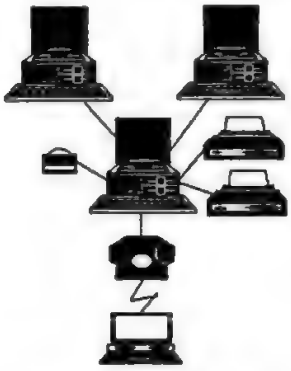

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■ PC TUTOR

used is the DOS FORMAT program. The logical format divides each track into sectors and writes additional information needed for DOS to the disk.

If FORMAT encounters a track that was forced bad by the physical formatter (even because of a single bad bit), it has no options. It must mark the entire track as bad. A standard hard disk is formatted for 512 bytes per sector and 17 sectors per track, so a bad track will cause CHKDSK to report 8,704 bytes in bad sectors.

If FORMAT finds an error on a track that was not marked bad by the low-level formatter, it has a different course of action available. (In any sector that it can't reliably read and write, FORMAT will note as bad and mark only the affected cluster. *(A cluster is the smallest amount of disk storage that can be allocated by DOS.) On a 20MB hard disk, sectors are handled in clusters of four. Thus, the same single bit error will cause CHKDSK to report only four sectors of 512 bytes per sector, or 2,048 bytes in bad sectors.*

Unfortunately, there are some errors that neither the physical formatter nor the DOS FORMAT program have the sophistication to detect. Over the long run some of these errors may crop up and cause loss of data when you least expect it.

A brand new 20MB hard disk that has 100K in bad bytes may seem bad, but if due to forced bad tracks, it boils down to just about 12 bad tracks out of 2,460, or .5 percent of all tracks. If you're optimistic, you can interpret the CHKDSK report as indicating that your dealer took the time to enter in the bad track list. Until you run out of room, you'll be glad your machine has been formatted with the most conservative approach available.

THE 80xx PARITY FLAG

I recently discovered an anomalous result in the setting of the 80286 parity flag. Arithmetic and logical operations can, of course, be performed on either bytes or words, and the processor flags reflect the state of the byte or word result, as appropriate. For example, the sign flag matches bit 7 of the result after a byte operation, but it matches bit 15 of the result after a word operation. The parity flag, however, always reflects the parity of the lower byte of the result only, even after a word operation, which affects the other flags according to the full 16-bit result.

I have tried this on only two processors. Has this behavior been documented anywhere? Is it a bug or was it intended? Does it vary among the '86 family members, or between manufacturers?

Bruce Frostick
Richmond, Virginia

To answer this question, I immediately grabbed my copy of The 8086 Book, *by Russell Rector and George Alexy (Osborne/McGraw-Hill, 1980). It's an indispensable guide for any 80xx assembly language programmer and includes complete information on opcodes, timing, and even program design and documentation.*

Regarding the parity flag, the authors say: "The parity status is set to 1 when the lower-order eight bits of any data operation result has an even number of 1 bits. An odd number of 1 bits causes the parity status to be reset to 0."

The parity flag works the same in Intel's current processors as it did in the 8080, which was a real 8-bit CPU. The operation was kept consistent for the sake of upward compatibility.

SIMULTANEOUS DISPLAYS

In the March 29, 1988, edition of PC Tutor, you indicated that the original IBM PC was designed to support simultaneous operation of two display types: monochrome and color. This is exactly what I would like to do, but I have only been able to effect an either/or switch of the active display adapter with the DOS MODE command.

Is there a DIP switch configuration or some other hardware or software that would allow me to run both monitors truly simultaneously?

Charles Forrest
Champaign, Illinois

The PC BIOS and DOS employ the concept of the active *monitor. Just as disk operations assume the current drive and directory by default, all video activity takes place on the active, or default, display. Just as DOS can't be told to perform all disk operations on drive A:* and *drive B:, it does not provide any support for sending the same output to both monitors simultaneously with a single command.*

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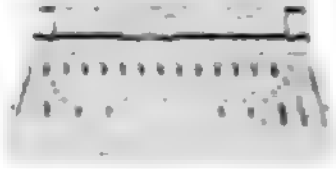

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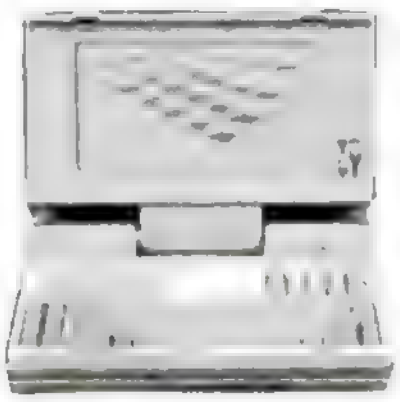

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■ PC TUTOR

If you're writing your own program, you can design it to display the same data on each monitor by performing two writes as two separate steps. But the lack of hardware support means that the program would have to assume the responsibility for switching the displays between writes.

If the MODE command isn't meeting your needs, take a look at the DOORS utility published in our February 5, 1985, issue. This program allows dual monitor systems to be switched between color and monochrome displays with a hotkey.

PATCHING REMOVE.COM

I use a lot of utilities from *PC Magazine*. Of these, INSTALL and REMOVE are my favorites for managing TSRs. REMOVE, however, requires that you hit the Enter key to peel off a layer of TSRs. That's great when you're at the DOS prompt, but when you have a menu system, there's no need.

Is there a way to patch REMOVE to avoid the prompt? This would allow readers to load and unload groups of TSRs automatically.

Daniel Murgo
Mendoza, Argentina

I agree. INSTALL, REMOVE, and PCMAP (PC Lab Notes, PC Magazine, August 1987) are three utilities I use every day to help manage my TSRs. But REMOVE isn't very friendly with batch files and insists on getting its keyboard input live. To help with this problem, I've devised two patches for the program.

Remember, before you try your hand at patching any program, always make a backup copy in case something goes wrong. You'll also need to have a copy of DEBUG either in the current directory or in a directory in your PATH statement.

The first patch involves replacing the BIOS get-a-key function with the DOS get-a-key function. This allows you to use the DOS redirection facility to feed characters from a file to REMOVE as if they came from the keyboard. First, enter the following commands to patch REMOVE.

```
DEBUG REMOVE.COM
E 204 B4 08 CD 21
W
Q
```

REMOVE will work just like it always has. Run it at the DOS prompt, and it will still ask you to press a key. But if you create a file that contains just the carriage return character and use redirection, REMOVE will execute without any keyboard input.

To create a response file that contains just a carriage return, enter the following commands:

```
COPY CON REMOVE.CR

^Z
```

The first line creates a file called REMOVE.CR and prepares to copy anything you type at the keyboard into it. The second line is blank—just hit the Enter key. The ^Z (Ctrl-Z) on the third line closes the file and is generated by holding the Ctrl key and pressing Z or hitting the F6 key. To run REMOVE automatically in a batch file, use the line

```
REMOVE <REMOVE.CR
```

If you're sure you'll never need to confirm a REMOVE, or you want to create a special batch version (you can rename the file), the following patch will remove all requirements for a response. Start with a fresh copy of REMOVE and type the following commands:

```
DEBUG REMOVE.COM
E 1FC EB 13
W
Q
```

For a batch operation, the list of installed TSRs and confirmation prompt that REMOVE produces can be eliminated by redirecting standard output to the NUL device. To do this, use the command

```
REMOVE > NUL
```

ASK THE PC TUTOR

The PC Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To see your questions answered here, drop a line to PC Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016. We're sorry, but we cannot answer questions personally. PC

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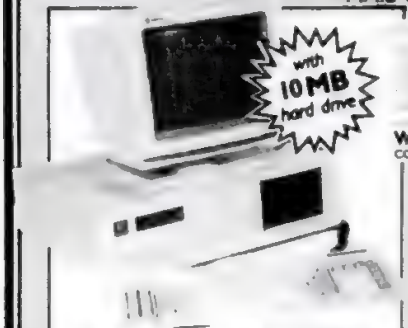

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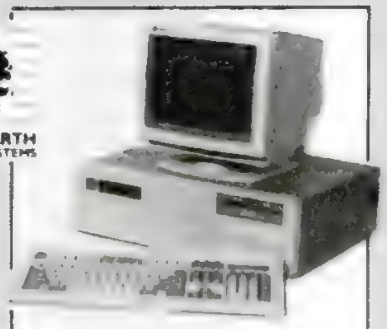

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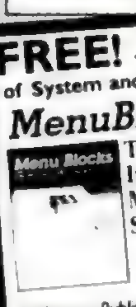

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Gary Ray in PC Week, May 17, 1988

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■ FRANK J. DERFLER, JR.

CONNECTIVITY CLINIC

Finding ARCnet's station address with BASIC; reading Ethernet's node identifications using C; terminating printer spooling in commercial programs automatically.

STOPPING PRINTER SPOOLING

Using 3Com's *3+Share* to release print files works nicely for programs written in-house ("LAN Printing Tip," Connectivity Clinic, February 29, 1988). Here is a way to terminate printer spooling in commercial programs.

If the program lets you set up the printer output device, print the output to a file called LPT1. Leaving off the colon tricks *3+Share* into thinking it is receiving a file, so it prints it immediately. But DOS still recognizes it as a device name, so the output goes to the printer linked to that device name.

This trick works with many popular programs. In *WordPerfect*, when you set up your printers (Shift-F7,4,3), choose 8 for Printer Port and enter LPT1 as Device or File Pathname. *Lotus 1-2-3* will not allow you to set up a filename as the global default, but when you are ready to print, type /PF (Slash Print File) instead of /PP (Slash Print Printer) and enter LPT1 (you first may need to press Esc once to clear the pathname from the command line).

Some of the more-advanced database languages, such as *DataFlex* by Data Access Corp., have a DeSpool command that may be embedded at the end of print routines, allowing automatic despooling of print files.

Robert Stockton
Surf City, New Jersey

Since DOS accepts device names with or without the semicolon, this trick is a slick way to slide a file through the print spool.

NODE ID WITH ETHERNET AND C

The program ENADR.C in Figure 1 extracts and prints the Ethernet network address for a 3Com 3C501 EtherLink card.

We use the output of this program as the input to another program that creates a DBMS key based on the Ethernet address. This key is guaranteed to be unique, since no other Ethernet card on the planet (regardless of the card's manufacturer) contains the same Ethernet address.

Dan Lasley
Cordova, Tennessee

```
#include "stdio.h"

#define L_GETEAR 6                          /* bytes in binary E/N address */
#define L_EA     (2 * (L_GETEAR + 1))       /* size of ASCII E/N address */
#define IE_GP    8                          /* xmit, station addr PROM pointer */
#define IE_SA    12                         /* station address PROM window */
#define EA_BASE  0x300                      /* Ethernet adapter base address */

main()
{
  int i, byte, base = EA_BASE;              /* 3C501 adapter I/O base address */

  for (i=0; i<L_GETEAR; i++) {
     outport (base + IE_GP, i);             /* point to E/N address byte */
     byte = inportb (base + IE_SA);         /* fetch address byte */
     printf ("%02x", byte & 0xff);
     }
  printf ("\n");
}
```

Figure 1: *ENADR.C extracts and prints the Ethernet network address.*

■ CONNECTIVITY CLINIC

We see here how to use C to get the same information from Ethernet cards that we will obtain in the next letter by using a BASIC programming exercise.

You don't have to force a reset on Ethernet cards to read their node IDs the way you do with ARCnet cards.

This program uses the C functions `outport` *(output a word to a port) and* `inportb` *(input a byte from a port).*

GETTING ARCNET'S NUMBER

We use an ARCnet network that runs under Novell's *NetWare*. Is there any way to determine the ARCnet station address from within a BASIC program?

Roy Goldberg
New York, New York

For the benefit of readers unfamiliar with ARCnet, let me explain that every ARCnet card is assigned a number from 1 to 255 (usually through DIP switches) when it's installed. However, no two cards can have the same number. To avoid assigning duplicate numbers when you're installing new cards, you must know the number of each card already on the network. If you don't have a record of the number assigned to each card, your only alternative is to take the cover off each machine and examine the DIP switches.

If you do have a record of the numbers assigned to the adapters, you will find them useful for configuring the parameters of programs as they start to run on each machine. The permanent numbers assigned to Ethernet and Token-Ring network interface adapter cards are often used for this purpose. When a program finds the number of the adapter card, it refers to a table and brings in the right video, keyboard, and other enhancement routines for that machine. In this case, we want a BASIC program to determine the identity of each machine so that we can customize other operations for the particular machine on which they are running.

■ Every ARCnet card is assigned a number when it's installed; no two have the same number.

We consulted with Standard Microsystems Corp., which said there is a relatively simple BASIC program that does what we want, but there's a catch. When you interrogate the card for this information, the act knocks the card off the network. This will force you to reinitialize NetWare *(by*

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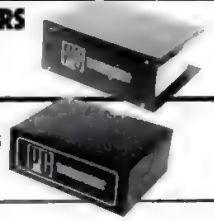

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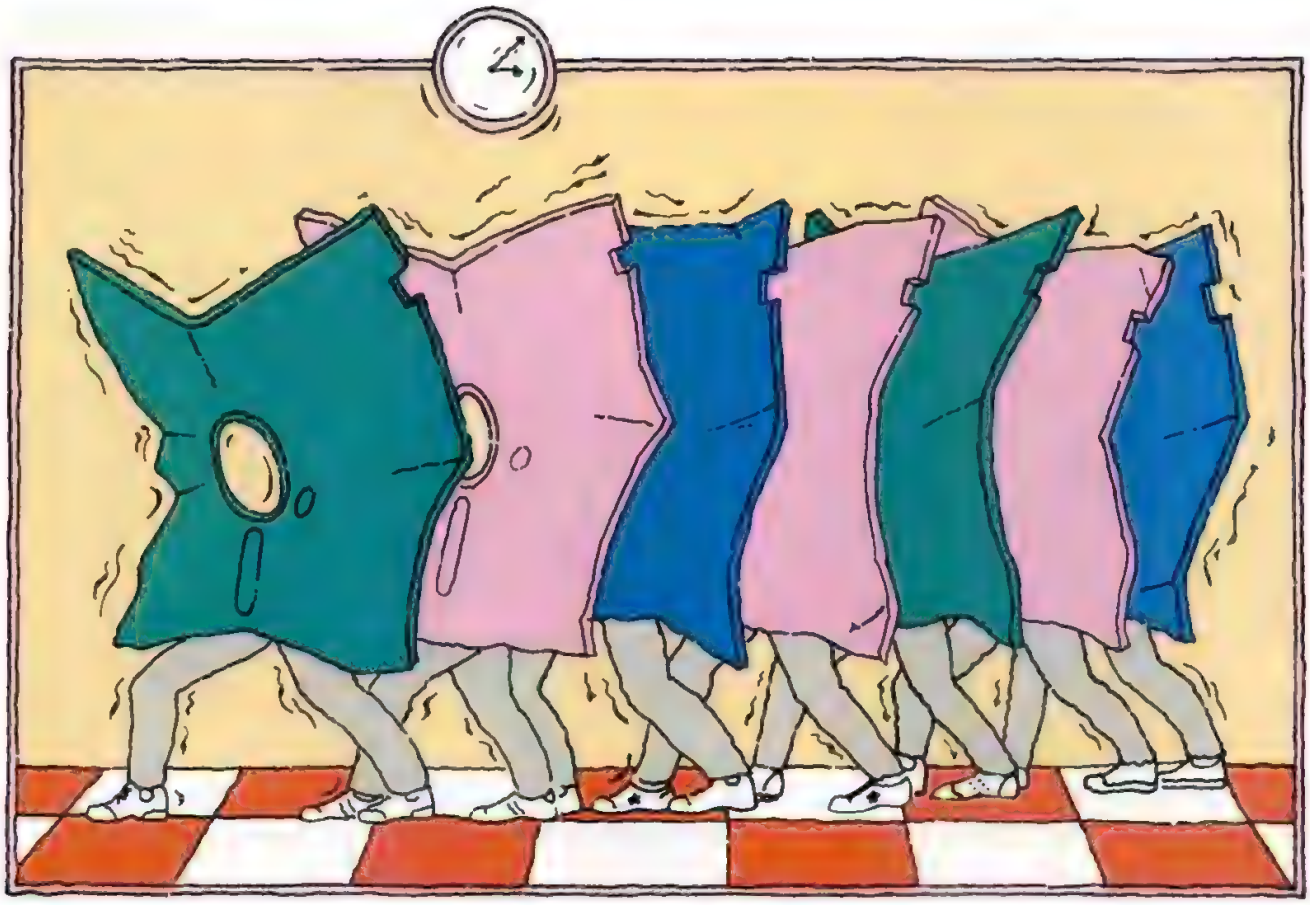

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■ CONNECTIVITY CLINIC

running Anet3 or IPX plus Net3).

The listing for this program is

```
ARCNET CARD NODE ID

 10  CLS:KEY OFF
 20  DEF SEG= &HD000
 30  OUT &H2E8, 8 :REM FORCES A RESET
 40  FOR I=1 to 1000
 50  J = I
 60  NEXT I
 70  J = PEEK(8) :REM CHECK RAM BUFFER
 80  IF J<>&HD1 THEN 40 :REM LOOK AGAIN
 90  K=PEEK(1) :REM READING NODE ID
100 PRINT "THE ARCnet NODE ADDRESS OF"
110 PRINT "THIS STATION IS ",K
120 END
```

You can download this program from PC MagNet (see the sidebar "SETMODE by Modem" in this issue's Utilities column).

No matter what application you have in mind, I suggest that after the program finds the identification number, you write that number to a file that can be read by subsequent programs. If this isn't acceptable, individual users can run Novell's UserList program to display the identity of active nodes. In the BASIC program shown, you must set the value in line 20 to the hex address of the RAM buffer. &HD000 is the typical value, but try &HC000, &HCC00, &HDC00, or &HE000 if that doesn't work.

You set the ARCnet board's base I/O hex address, plus 8 bits, in line 30. The typical hex values of &H2E0 and &H300 become &H2E8 and &H308.

The OUT command in line 30 forces a reset of the ARCnet card. This reset forces the card to transmit its node ID number, but it also drops the card from the network.

The loop and PEEK in line 70 is a routine that looks for D1, the reset complete indicator, in the RAM buffer. If that indicator is present, line 90 reads the node ID in the second byte.

NETWORK YOUR QUESTIONS

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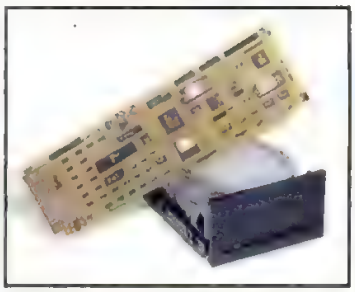

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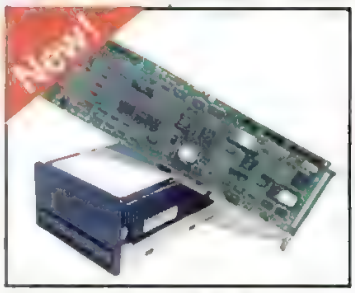

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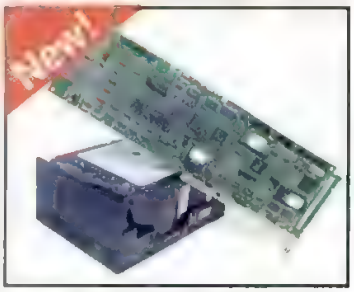

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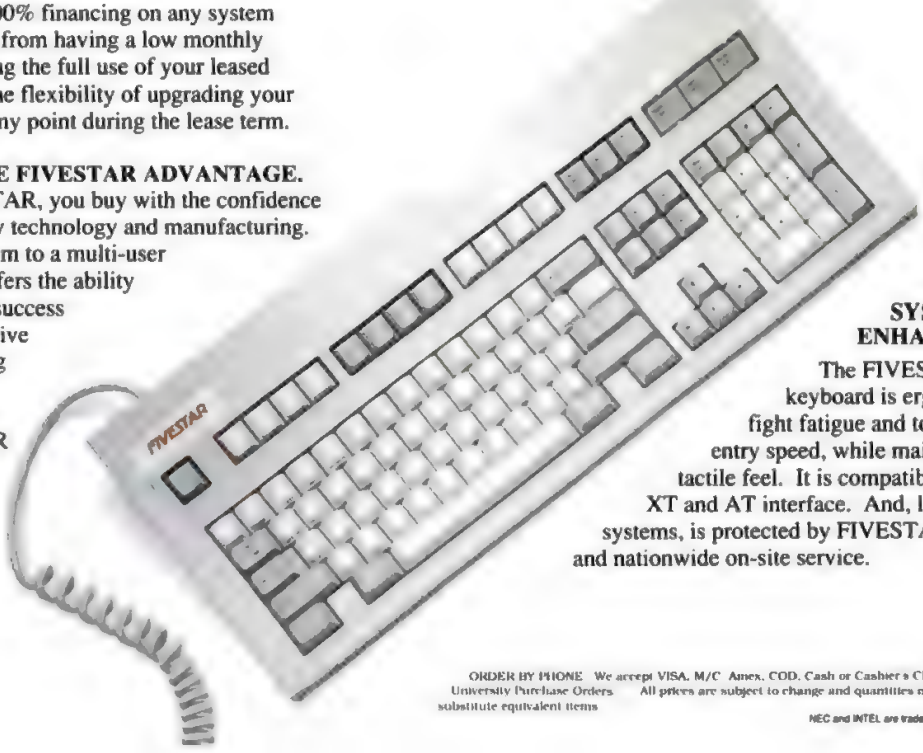

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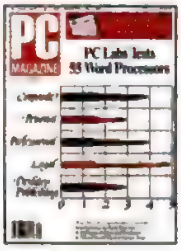

2/29/88—PC Labs tests 55 word processors; 1987 tax prep software; IBM's 20-MHz PS/2 Model 80 benchmarked; living with laser printers; keyboard monitors under OS/2; 1-2-3 competitor Surpass; PC Macterm; Primetime Personal time-management software; OS/2 ThinkTank upgrade; Connex comm software; more.

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1/12/88—THE BEST OF 1987—4th Annual Best & Worst Editors' Personal Picks; 1987 Awards for Technical Excellence; Tandy's 1000 Series; remote computing solutions; 4 Fiber-optic LANs; PC Labs tests 5 communications programs; 9 plug-and-play data transfer products; FREE Help utility; more.

12/22/87—Microsoft Excel reviewed; PC Labs tests 9 affordable 386-based PCs; 16 EGA Plus cards reviewed; 8 plotters; 6 TSR note-takers; 5 sales-lead trackers; Microsoft Windows; Omnis Quartz; Windows Graph; adding subdirectories and hard disk compatibility to rejuvenate old programs; FREE PRN2FILE.COM program printing utility; more.

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11/10/87—PC Labs torture-tests 106 printers; 36 laser printers, $1,795–$18,750, 300–1200 dpi; 65 dot-matrix printers; 5 daisy-wheel printers; soft-font primer; first look at Microsoft Excel; customizing cursors with CTYPE; Compaq Deskpro 86/20 and portable 386; FREE SAFARI internal error handling utility for PC-DOS; more.

10/27/87—PC Labs tests 10 hot spreadsheets; 3-D spreadsheets that provide missing links; new models, new screens for laptops; 6 presentation-size monitors; 386 Turbo boards; the new MultiMate; text-oriented database software; FREE super clipboard utility works with any application; more.

10/13/87—Desktop publishing on the PC; PC Labs tests GEM Desktop Publisher, The Office Publisher, PageMaker and Ventura Publisher; the best large-screen monitors, laser printers, mice and scanners; 7 highest-speed ATs; 32 breakthrough text and graphics scanners; 31 spelling checkers; FREE pop-up address book and dialer; more.

9/29/87—PC Labs tests 12 hot 386 boxes; 12 keyboard macro programs; 13 full-featured project managers; laptop add-ons; 14 disk diagnostic programs; OS/2 and Languages columns premiere; first looks at Turbo C and IBM's Model 25; KBX keyboard extender examined; FREE RN subdirectory utility; more.

8/87—36 high-tech input devices examined including tablets, trackballs, touchscreens, light pens, mice and keyboards; 9 Norton challengers; 11 AT multifunction boards; 6 database graphic systems; TSR desktop organizers; 13 Sidekick rivals; FREE Directory Magic utility program; more.

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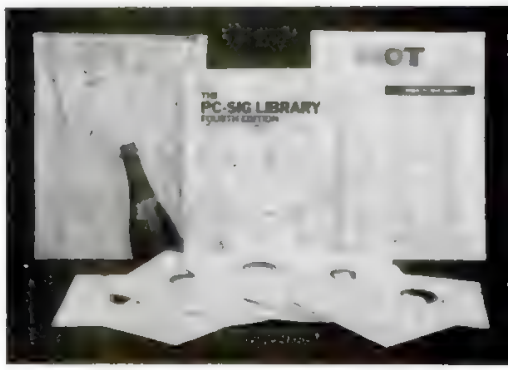

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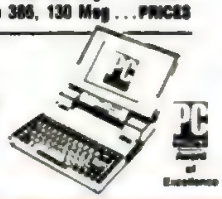

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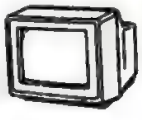

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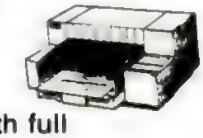

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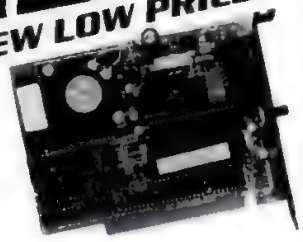

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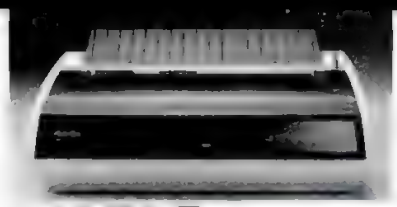

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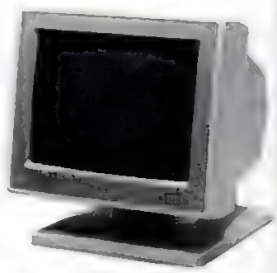

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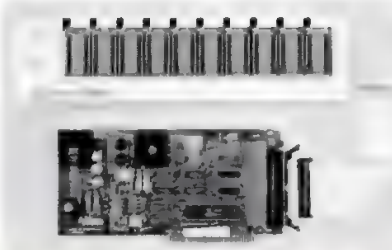

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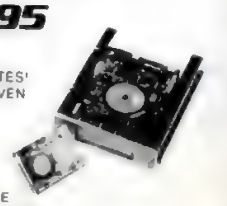

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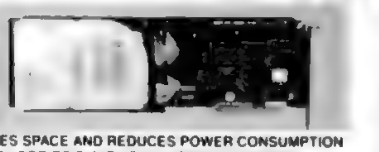

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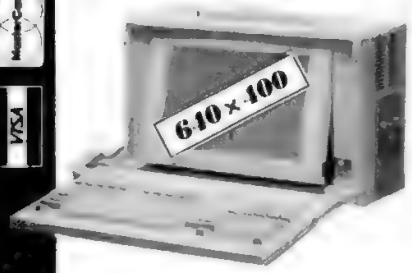

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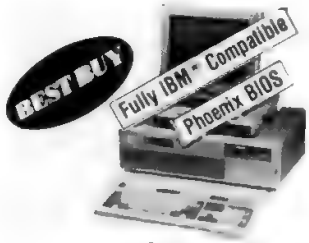

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19. One RS-232 Serial Card w/2nd Port Optional
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21. 80287 Math Co-Processor Socket Installed on Board
22. Socket-Plated, Enamel-Coating, Heavy-Duty Lockable Case
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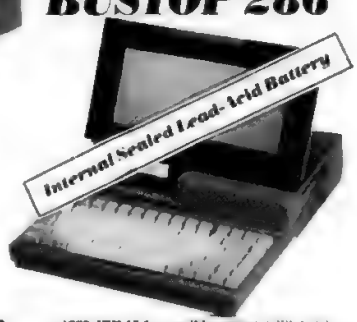
BUSTOP 286



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7. Intel 32-Bit 80386-16 Microprocessor
   - Operating at 16MHz "0" Wait
   - Software-Selectable of Four Speeds: 4.77/8/16
8. Performance Rating: 9MIPS = 2.03, 9 = 40.7, Landmark = 29.5
9. 80287-80387 Math Co-Processor Socket Installed
   - 80387 Is a 32-Bit Operation
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   - 80387 Runs with Turbo Pascal/Autocad Version 2.60/Full CADAM Support
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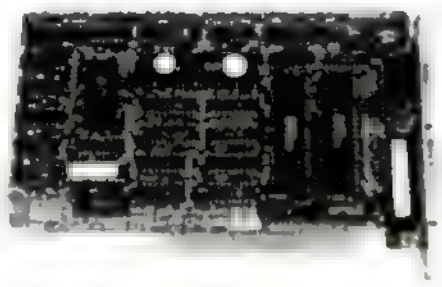

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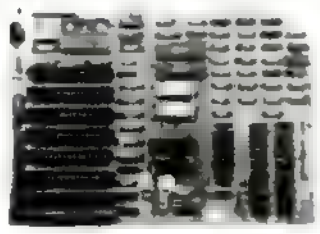

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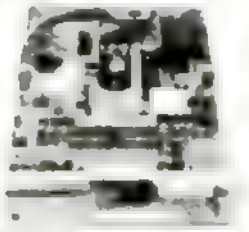

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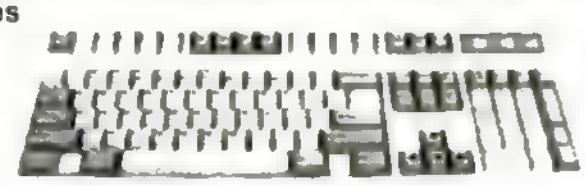

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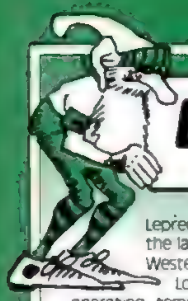

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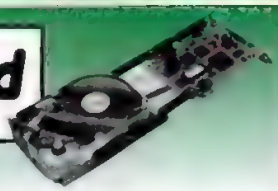

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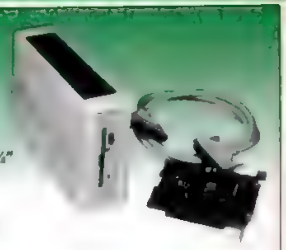

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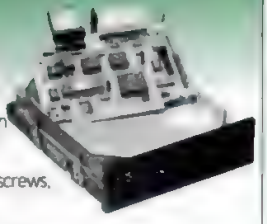

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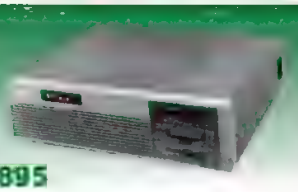

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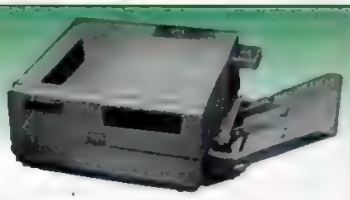

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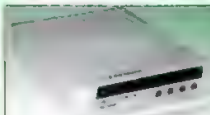

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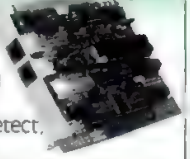

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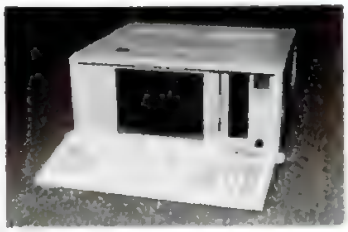

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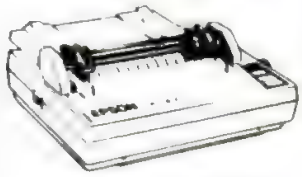

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PC MAGAZINE

THE SHOWCASE FOR PRODUCTS AND SERVICES IN THE MS DOS MARKET . . .

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PRODUCT CATEGORIES

HARDWARE

ADD-ON-BOARDS 485
CABLES 485
COMMUNICATIONS . 485, 486
COMPUTER SYSTEMS 486, 487
DISK DRIVES 487, 488
DISKETTES 488, 489
EXPANSION UNITS 489, 490
MONITORS . . . . . .
PERIPHERALS 490
PLOTTERS 491
POWER PROTECTION . . . . . .
POWER COOLING SUPPLIES 491
PRINTERS 491
SECURITY 491
SPEED DEVICES 491

SOFTWARE

ACCOUNTING 492
ARTIFICIAL INTELLIGENCE . . . . . .
BACKUP SYSTEMS . . . . . .
BUSINESS 492, 493
BUSINESS PROJECT MANAGEMENT 493
BUSINESS TIME MANAGEMENT . . . . . .
COMMUNICATIONS 493
CONSTRUCTION 493
DATA BASE 494
DATA ENTRY 494
DATA MANAGEMENT . . . . . .
DESKTOP PUBLISHING 494, 495
EDUCATION 495
ENGINEERING 495, 496
ENTERTAINMENT/ GAMES 496
FINANCIAL 496, 497
FLOWCHARTING . . 497, 498
GENERAL 498
GRAPHICS 498
HEALTH 498
INVENTORY 498
LANGUAGES 498
LEGAL . . . . . .
MAILING PROGRAMS 499
MANUFACTURING 499
MEDICAL 499, 500
MULTI-USER SYSTEMS . . . . . .
MUSIC 500
ONE-OF-A-KIND . . . . . .
OPERATION SYSTEMS . . . . . .
PREVENTATIVE MAINTENANCE . . . . . .
PROGRAMMERS TOOLS 501
PUBLIC DOMAIN . . 501, 502
REAL ESTATE 502, 503
RELIGION 503
SALES MARKETING 503, 504
SCIENTIFIC . . . . . .
SECURITY 504, 505
SERVICES . . . . . .
SHAREWARE 505
STATISTICS 505, 506
SURVEYS 506
TAXES . . . . . .
TERMINAL EMULATION 506
TRAVEL . . . . . .
UTILITIES 506, 507, 508
WORD PROCESSING 508

MISCELLANEOUS

ACCESSORIES 508, 509
BAR CODING 509, 510
BOOKS . . . . . .
BUSINESS OPPORTUNITIES . . . . . .
CATALOGUES 510
COMPUTER INSURANCE 510
COMPUTER LEASING . . . . . .
COMPUTER SERVICES . . . . . .
CONSULTANTS . . . . . .
CONVERSION SERVICE . . . . .
DATA CONVERSION 510
DIGITIZERS . . . . . .
DISK CONVERSION . . 510, 511
DISKETTE COPY SERVICE 511
EMPLOYMENT OPPORTUNITIES . . . . . .
FURNITURE . . . . . .
MAILING LISTS 511
NETWORKING 511
PUBLICATIONS 511
SUPPLIES 512
TRAINING/TUTORIALS . 512
TYPESETTING 512
USED EQUIPMENT . . . . . .

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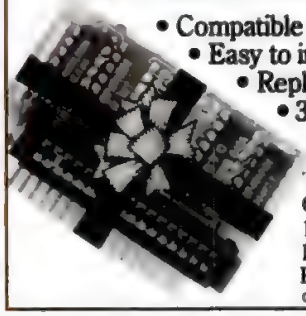

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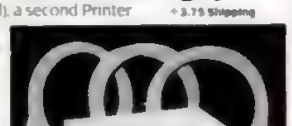

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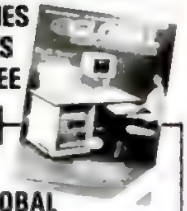

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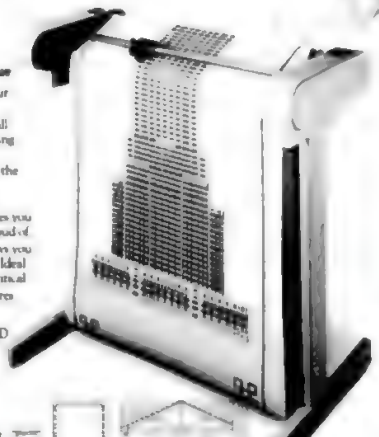

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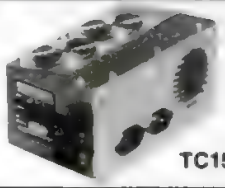

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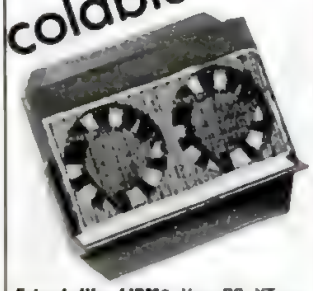

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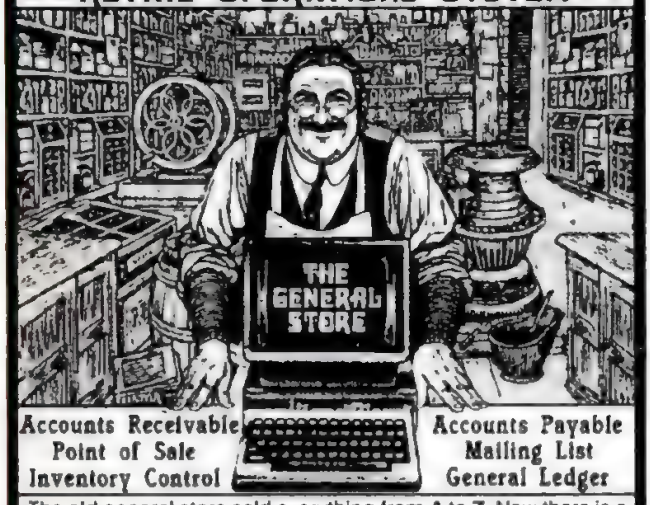

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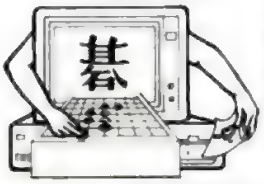

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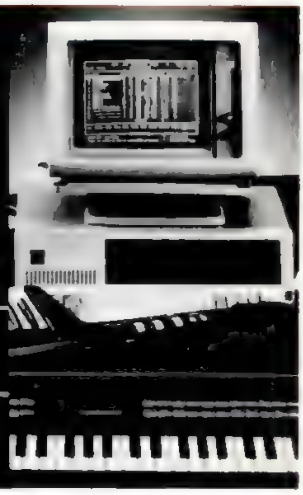

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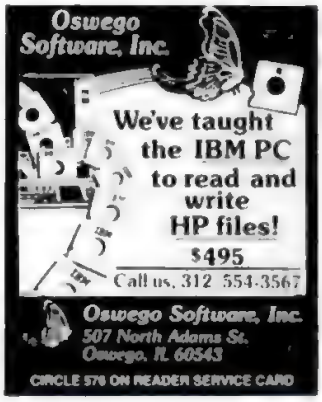

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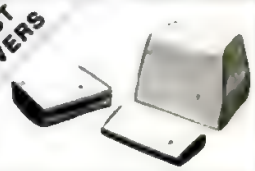

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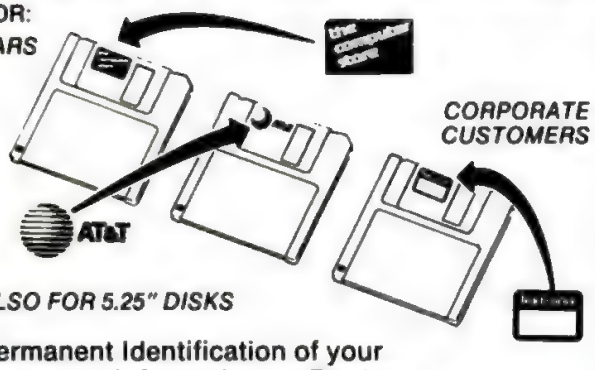

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EDITORIAL PRODUCT INDEX

READER SERVICE NUMBER	PRODUCT	COMPANY	PAGE
ADD-IN BOARDS			
430	CuRAM 80-8	Cumulus Corp.	43
697	Designer VGA	Orchid Technology	98
699	Everex EVGA	Everex Systems Inc.	94
661	IBM 8514/A Display Adapter	IBM Corp.	116
660	IBM 8514 Color Display	IBM Corp.	116
659	IBM 8514 Memory Expansion Kit	IBM Corp.	116
698	Intelligent VGA Board	Intelligent Data Systems Inc.	90
696	Paradise VGA Plus Card	Paradise Systems Inc.	100
695	Sigma VGA/H	Sigma Designs Inc.	107
694	Tatung VGA Platinum Card	Tatung Co. of America Inc.	111
692	Tecmar VGA	Tecmar Inc.	118
693	Ultra-Grafix VGA Model 580 Card	Taxan USA Corp.	111
691	VEGA VGA	Video Seven Inc.	120
AFTER HOURS			
649	Campaign Promises	Front Runner Software	524
645	Bob and Jean Anderson's Computer Stretches	FB Systems Inc.	521
648	Family Reunion	FAMware	522
647	Family Roots	Quinsept Inc.	520
646	Roots II	Commsoft	520
COMMUNICATIONS			
690	Ascom IV	Dynamic Microprocessor Associates	128
689	BitCom	BIT Software Inc.	132
680	Boyan	Boyan Communications	135
679	Crosstalk Mk.4	Digital Communications Associates Inc.	138
678	Crosstalk XVI	Digital Communications Associates Inc.	142
688	Freeway Advanced	Kortek Inc.	147
677	HyperAccess	Hilgraave Inc.	148
687	Lync	Norton-Lambert Corp.	154
686	MEX-PC	NightOwl Software Inc.	156
675	Mirror II	SoftKlone Distributng Corp.	158
674	ProComm	Datastorm Technologies Inc.	160
673	ProComm Plus	Datastorm Technologies Inc.	160
606	Professional-YAM	Omen Technology	167
672	Ptel	Phoenix Technologies Ltd.	172
685	Qmodem	The Forbin Project	176
684	Relay Gold	Vm Personal Computing	179
683	684	Vm Personal Computing	179
671	Respond/Async	Software Synergy Inc.	187
682	SideTalk	Lattice Inc.	190
681	Smartcom III	Hayes Microcomputer Products Inc.	192
670	Softerm	Softronics Inc.	196
COMPUTERS			
438	ALR FlexCache 25386	Advanced Logic Research Inc.	51
683	Amdek System 286A	Amdek Corp.	209
682	Arche Rival 286	Arche Technologies	216
681	Core ATomizer	Core International	224
680	Dataworld Data 286	Dataworld	226
679	Epson Equity II Plus	Epson America Inc.	224
437	Everex Step 386/25	Everex Computer Systems Division	51
678	Hyundai Super-286C	Hyundai Electronics America	232
677	Kaypro 286	Kaypro Corp.	235
441	MicroDirect Complete Portable Office	MicroDirect Inc.	51
676	Mitac Paragon 286F	American Mitac Corp.	214
436	Mitsubishi MP286L	Mitsubishi Electronics America	52
447	Northgate Power 386	Northgate Computer Systems	54
443	PC Office NT-10	PC Office	52
675	Star Industries AT 286	Star Industries	244
445	Toshiba T5100	Toshiba Amenca Inc.	33
DATABASE MANAGEMENT			
450	Emerald Bay	Migent Inc.	36
DESKTOP PUBLISHING			
433	Super Cartridge I	IQ Engineering	38
GRAPHICS			
448	Draw Applause, Version 1.0	Ashton-Tate	48
SCANNING			
444	GEM Scan	Digital Research	46
440	Mitsubishi MH 216	Mitsubishi Electronics America	51
439	ScanMan	Logitech Inc.	51
SOFTWARE			
446	IZE	Persoft Inc.	33
TUTORIALS			
431	Dan Bricklin's Demo II Program	Software Garden Inc.	43
449	Taming MS-DOS, 2nd edition	M&T Books	38
UTILITIES			
432	SolveIT, Version 3.3	Structured Scientific Software	46
435	The Image Printing Utilities	Image Computer Systems	56
434	Tree86, Version 2.0	The Aldridge Co.	56
WORD PROCESSING			
643	Alexander	Design Enterprises of San Francisco	117
642	ChiWriter	Horstmann Software Design Corp.	71
641	The Egg	The Peregrine Falcon Co.	129
640	EXP	Wadsworth & Brooks/ Cole Advanced Books & Software	129
631	Lotus Manuscript	Lotus Development Corp.	131
639	PCTeX	Personal TeX Inc.	130
638	PS	Scroll Systems Inc.	138
637	Spellbinder Scientific	Spellbinder Software Products Inc.	304
632	T3	TCI Software Research Inc.	308
636	Tech/Word	Goldstein Software Inc.	312
635	TechWriter	CMI Software	316
634	Total Word	Lifetree Software Inc.	318
633	WordMarc Composer	Marc Software International Inc.	324

PRODUCTIVITY

DEPARTMENT	PROGRAM NAME/DESCRIPTION	PAGE
PC Lab Notes	QFRESH postpones the refresh cycle of DRAM chips to boost speed.	331
Utilities	SETMODE helps set up your video mode and communications parameters.	351
Environments	BOXES1.C uses the OS/2 1.1 Presentation Manager's graphical interface.	579
Power Programming	QFN stores incomplete filenames in fully qualified drive-and-path form.	397
Spreadsheet Clinic	Macro enters a series of month-spaced dates into a 1-2-3 column.	413
Spreadsheet Clinic	Instantly editing 1-2-3 and Symphony cells that /Data Query Find locates.	414
Spreadsheet Clinic	Macro uses a subroutine call to return to saved addresses of 1-2-3 cells.	414
Spreadsheet Clinic	Formula calculates grand total of a multiple-section 1-2-3 worksheet.	416
User-to-User	INTENSE.COM forces CGA to use its brighter color palette as the default.	419
User-to-User	Danger of overwriting files when using DOS's APPEND command with BASICA.	419
User-to-User	Batch files that help you quickly develop MASM and IBM COBOL/2 programs.	420
Power User	Speeding up WordPerfect by copying it to a RAMdisk.	427
Power User	WordPerfect macros create a concordance file of words and phrases.	427
Power User	WordStar's spell checker, and Microsoft Word thesaurus as spell checker.	428
Power User	Finding current drive and directory in dBASE, DBXL, Quicksilver, FoxBase.	428
Power User	Clipper routines to determine the current drive and subdirectory.	431
Languages	Making and downloading custom fonts to Epson or IBM dot matrix printers.	435
Languages	MERGE.C merges C source code with Turbo C compiler's assembler output.	436
Languages	Turbo Pascal Coprocessor Clock program creates a real-time clock display.	440
PC Tutor	How sectors are marked as bad on IBM PS/2 Model 50 hard disks.	447
PC Tutor	Relation of 80xx parity flag setting to bits in a data operation result.	448
PC Tutor	Simultaneously displaying mono and color on two-monitor IBM PC systems.	448
PC Tutor	Patching PC Magazine REMOVE.COM utility to eliminate Press ENTER prompt.	450
Connectivity Clinic	Stop print spool in 1-2-3 and WordPerfect (with 3+Share), and DataFlex.	453
Connectivity Clinic	ENADR.C extracts Ethernet network address for 3Com 3C501 EtherLink card.	453
Connectivity Clinic	Finding a station address on an ARCnet network running Novell's NetWare.	454

ADVERTISERS PRODUCT INDEX

RS#	ADVERTISER	PRODUCT	PAGE#
GENEALOGY SOFTWARE			
	GeneaLogic Systems	Lineage Master	
ACCOUNTING SOFTWARE			
185	Aptech Inc	Abraxas	293
482	Bedford Software Limited	Accounting Software	320
281	Computer Associates	Super Project Plus	401
194	Cougar Mt Software	Accounting Software	371
220	DAC Software	Accounting Software	69
200	Integrated Information Service	Accounting Software	21
263	Macola Inc	Accounting Software	442
358	Peachtree Software	Accounting Software	330
470	SBT Corp	Database Accounting	18-19
DESK TOP ORGANIZERS			
137	Borland International	Sidekick Plus	55
*	Lotus	Metro	149
*	Micro Logic Corp	Tornado	347
384	Qandu Computing, Inc	Rollcall	250
DATABASE MANAGERS			
519	Ashton Tate	Rapid File	376-377
471	askSam System	Free Form Database	86
377	Borland International	Paradox	57
494	Buttonware	PC File	326
327	Revelation Technologies, Inc	Advanced Revelation	412
148	dbFast	dbFast	307
112	Fox Software Inc	Mac Database	87
176	Micronm	Rbase	424-425
*	Oracle	Database Management Software	47
145	PC Sig	Shareware	463
348	Research Development Systems	Letter Master	350
745	Symantec	Q & A 3 0	45
529	The Public (Software) Library	S/W By the Public S/W Library	392
508	Wordperfect Corporation	Dataperfect	395
FILE SYSTEMS & ACCESS METHODS			
502	Group L Corporation	Memory Lane	326
302	Micro Com Systems	Multifunction & Pub Domain S/W	16
526	Microlytics	Gofer	185
145	PC Sig	Shareware	463
529	The Public (Software) Library	File Systems & Access Methods	392
FINANCIAL PLANNING SOFTWARE			
*	Intuit Software	Quicken	231
145	PC Sig	Shareware	463
INFORMATION MANAGERS			
*	Lotus	Agenda	119-121
302	MicroCom Systems	Multifunction & Pub Domain S/W	16
*	MicroLogic Corp	Tornado	347
INTEGRATED SOFTWARE			
130	Computer Ease Software	Word Mover	316
*	Informix Software Inc	Smart Ware	180-183
*	Lotus	Symphony	247
263	Software Group, The	Enable	186
LANGUAGES			
360	Crescent Software	Basic Programming Tools	443
*	Microsoft	Quick C	C8
*	Microsoft	Quick Basic	327
331	Microway	Fortran Compiler	334
OPERATING SYSTEMS/ENVIRONMENTS			
474	Quarterdeck	Desqview	99
245	Santa Cruz Operation, Inc	SCO XFNIX 386	366
*	Softlogic Solutions	Software Carousel	168
*	Softlogic Solutions	Double Dos	168
393	Software Link, Inc	PC MOS/386	212-213
PROGRAM DEVELOPERS/GENERATORS			
134	Clarion Software	Clarion	70
360	Crescent Software	Basic Programming Tools	443
PROJECT MANAGEMENT			
249	Symantec/Breakthrough	Timeline 2 0	42
STATISTICAL SOFTWARE			
154	Math Soft Inc	Math Cad	305
TEXT EDITORS			
188	Command Technology Corp	SPF/PC	428
UTILITIES			
137	Borland International	Sidekick Plus	55
120/160	Central Point Software	PC Tools Deluxe, Option Board	74-75
134	Clarion Software	Clarion	70
360	Crescent Software	Basic Programming Tools	443
148	dBFast	dBFast	307
323	Funk Software	Sideways, Noteworthy, Inword	82-83
369	Golden Bow Systems	V-Opt	4
502	Group L Corporation	Memory Lane	326
380	Hammerly Computer Services, In	Pro Bas	335
302	Micro Com Systems	Multifunction & Pub Domain S/W	16
*	Micro Logic Corp	Tornado	347
211	Paul Mace Software	Paul Mace Utilities	309
489	Personal Computer Support	Breakthru	10
282	Personics Corp	See More	17
*	Personics Corp	See More	406
384	Qandu Computing, Inc	Rollcall	250
*	Quad Software Ltd	Utilities	304
290	Rose Electronics	Passport	308
334	Softlogic Solutions	Disk Optimizer	39
*	Softlogic Solutions	Software Carousel	168
*	Softlogic Solutions	Magic Mirror	168
*	Softlogic Solutions	Cubit	168
*	Softlogic Solutions	Disk Optimizer	168
*	Softlogic Solutions	Double Dos	168
726	Software Excitement	Shareware Software Products	318
319	Sterling Castle	Forget Me Not Software	341
*	Transecsystems, Inc	Unlock Master Key/Game Master	437
222	Traveling Software	Laplink	325
312	White Crane Systems	Brooklyn Bridge	28
WORD PROCESSING SOFTWARE/AIDS			
218	Bitstream	Fonts	257
130	Computer Ease Software	Word Mover	316
292	Corporate Software	Upgrade Program	319
502	Group L Corporation	Memory Lane	326
302	MicroCom Systems	Multifunction & Pub Domain S/W	16
240	Micropro International	Wordstar	358-359
479	Rightsoft, Inc	Right Writer	37
*	Software Publishing	Professional Write	264-265
250	Symantec	Q & A Write	58
518	Xyquest	Word Processing Software	134
CAD/CAM			
475	American Small Business Comp	Cad Software	353
165	Autodesk	Autosketch	313
506	Generic Software Inc	Generic Cadd	378
SPREADSHEET/TEMPLATES			
323	Funk Software	Sideways, Noteworthy, Inword	82-83
*	Microsoft	Excel	C5-7
145	PC Sig	Shareware	463
483	Personal Computer Support Group	Lucid	12-13
282	Personics Corp	See More	17
*	Personics Corp	See More	406
*	Softlogic Solutions	Cubit	168
234	Software Spectrum	Lotus	381
529	The Public (Software) Library	Spreadsheet/Templates	392
DESK TOP PUBLISHING			
128	Aldus Corp	Pagemaker	198-201
218	Bitstream	Fonts	257
499	IMSI	Page Perfect	29
*	Softlogic Solutions	Magic Mirror	168
299	Swfte International, Ltd	Glyphix	109
259	The Laser Connection	Jetscript	5
DATA ENTRY SOFTWARE			
174	Form Worx Inc	Form Worx	101
VERTICAL MARKET SOFTWARE			
149	Bible Research Systems	The Word Processor	481
COMPATIBLE KEYBOARDS			
723	Zeos International	Compatible	79
721	Zeos International	Compatible	234
BACKUP SOFTWARE			
485	Westlake Data Corp	Backup Software	312
DISK BACKUP & TAPE DRIVES			
527	Archive	Back Up	314
261	Compact Disc Products	CD-ROM	308
378	Iomega Corporation	Removable Hard Disk Drives	360
219	Irwin Magnetics	Tape Back Up	248-249
193	Kinson Products	Floppy disk	124
495	Maynard Electronics	Tape Back Up	430
173	Sysgen Inc	5¼" Bridge-File Floppy Disk	218
233	Tallgrass Technologies	Disk Back Up	306
HARD DISKS			
341	Lifetime Memory Products	Hard Disk Drives	457
164	Plus Development	Hardcard Micro Manager	294-295
271	Sony Corp	Cd ROM	193
232	Tandon Corp	Datapac	362-363
COMPUTERS/COMPATIBLES			
111	Arche Technologies	Arche Rival 286	208
296	B S I	PC	420
275	Bentley Computers	Compatibles	410-411
481	Bulldog Computer Products	Computer/Accessories	432-433
320	Compu Add Corp	Compatibles	161
163	Computer Products United	PC	174-175
225	Core International	Atomizer	261
*	Dataworld	PC	426
257	Entre Computer Centers	Computer Centers	217
216	Everex Systems, Inc	Desktop Computers	274-275
386	Five Star Electronics, Inc.	PC Compatibles	458-459
740	GE Computer Service	Computer	417
357	Hewlett Packard-Vectra	Vectra PC	104-105
124	Hyundai	PC Compatible	454
*	IBM Corp	ASC Terminals	396
496	Insignia Solutions	Soft PC	407
382	Intelligent Microsystems	Clone Computers	444-445
343	Kaypro	286 Computer	333
102	May Computers	PC	197
*	Northgate Computer Systems	286 At Machine	404-405
310/311	PC Brand	Clone & Software	22-23
372	PC Designs	Compatible	421
336	Dell Computer	PC Compatibles	114-115
539	Dell Computer	PC Compatibles	112-113
298	Samsung	AT/XT Compatibles	446
390	Speld Computer Systems	386 & 286	50
254	Sun Microsystems	Sun 386J	170-171
*	Toshiba	Laptops	236-237
329	Vertex Systems	PC	233
734	WYSE Technology	Modular Systems Architecture	229
INPUT DEVICES			
133	Logitech	Mouse	188-189
182	Logitech	Mouse	215
350	Mouse Systems	PC Mouse	297
*	Northgate Computer Systems	Keyboard	452

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151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200
201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250
251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300
301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350
351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400
401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450
451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500
501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550
551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600
601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650
651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700
701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750
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801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850
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PC 7/88-2

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201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250
251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300
301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350
351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400
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451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500
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601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650
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701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750
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801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850
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p. ☐ Linked to mini
q. ☐ Networked together
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r. ☐ Mainframe(s)
s. ☐ Mini(s)
7. Do you plan to to buy
t. ☐ Now
u. ☐ In 4 to 6 months
v. ☐ In 6 to 12 months
w. ☐ No definite plans
8. Number of employees in your entire company?
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y. ☐ 26-99
z. ☐ 100-499
1. ☐ 500-999
2. ☐ 1000 or more

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RS#	ADVERTISER	PRODUCT	PAGE#
PROGRAMMERS TOOLS UTILITIES			
116	Blaise Computing	Blaise Compiler	392
360	Crescent Software	Basic Programming Tools	443
148	dBFast	dBFast	307
380	Hammerly Computer Services In	Pro Bas	335
487	Software Masters	The Visible Computer	304
488	Software Masters	Programming Tools	317
ADD-ON BOARDS			
345	Alloy Computer Products	PC Plus	202
166	AST Research	VGA Board	415
540	ATI Technologies Inc	VGA Board	281
120/160	Central Point Software	Copy II PC Deluxe Option Board	74-75
159	Everex Systems, Inc	EGA Boards	184
265	IDE Associates	PS/2 Boards	136-137
252	Sigma Designs	VGA Boards	441
513	Wordperfect Corporation	Add In Board	348-349
SCANNERS/DIGITIZERS			
318	Chinon	Scanner	191
247	Data Copy	Scanner	245
PRINTERS			
242	Alps America	Printer	262-263
328	Buffalo Products	SX Peripheral Sharing Device	429
114	Citizen America Printer	Printers	2-3
152	Data Technology Corp	Crystal Print	255
241	Diconix	Printer	270-271
339	Hewlett Packard	Deskjet	388
224	Mannesman Tally	Laser Printers	194
235	Okidata	Printer	311
129	Output Technology	OTC 850XL	322
119	Panasonic Computer Division	Laser Printers	387
749	Ricoh of America	Laser Printers	211
259	The Laser Connection	Jetscript	5
*	Toshiba	Printers	385
PRINTER RIBBONS			
344	National Computer Ribbons	Computer Ribbons	473
PRINTER ACCESSORIES			
172	Bay Technical Associates	Print Master II	178
290	Rose Electronics	Porter-Masterswitch	308
PORTABLE/LAP COMPUTERS			
313	Datavue	Spark	399
371	Mitsubishi Electronics	Laptop	364-365
*	Toshiba	Laptops	236-237
PC FAX			
189	Quadram Corp	JT Fax	359
DISPLAYS/MONITORS/TERMINALS			
101	Magnavox	Monitor	110
131	NEC Home Electronics Inc	Multisync	122-123
115	NEC Home Electronics Inc	Monitor	240-241
309	Princeton Graphics	DTP Monitors	126
271	SONY Corp	Monitors	193
337	Zenith Data Systems	Monitors	155
GRAPHICS SOFTWARE			
324	Ashton Tate	Draw Applause	334-335
174	Form Worx Inc	Form Worx	101
201	Haventree Software	Flow Charts	438
*	Lotus	Freelance Plus	225
*	Lotus	Freelance Plus	227
*	Lotus	Graphwriter	157
*	Lotus	Graphwriter	159
*	Micrografx	Graphics S/W-Windows Pres Mgr	97
325	Zenographics	Graphics	8
PLOTTERS/CHARTING DEVICES			
373	Mutoh America Inc	Plotters	285
VIDEO GRAPHICS/BOARDS			
166	AST Research	VGA Board	415
239	Genoa Systems Corp	VGA Board	382
359	Paradise Systems	VGA Boards	125
150	Truevision Inc	VGA Board	173
127	Video-7	VGA Board	101
513	Wordperfect Corporation	Graphics Video Display	348-349
ACCELERATOR BOARDS			
276	Hauppauge	386 Motherboard	32
489	Personal Computer Support	Breakthru	10
COMMUNICATIONS SOFTWARE			
130	Computer Ease Software	Word Mover	316
504	Data Storm Technologies Inc	Communications Software	139
330	Dynamic Microprocessor Assoc	Chairman	389
170	Equinox Systems Inc	Switchlan	456
136	Hayes Microcomputer Products	Communications Software	372
226	Meridian Technology	CC Express	133
217	Norton-Lambert	Close-up	20
722	PCC Systems	CC Mail	324
290	Rose Electronics	Passport	308
478	Softklone	Mirror II	328
222	Traveling Software	Laplink	325
256	Relay Communications	Relay Gold	144-145
312	White Crane Systems	Brooklyn Bridge	28
LOCAL AREA NETWORKING			
230	A S P Computer Products	Simplan	406
345	Alloy Computer Products	PC Plus	202
140	American Power Conversion Corp	UPS	368
395	Axon	LAN	329
328	Buffalo Products	SX Peripheral Sharing Device	429
326	DCA/Crosstalk Communications	MARK IV	152-153
278	DCA	Mark IV	76
532	DCA/FOX	10 NET	262-263
525	Excell Tech	LAN	448
146	Gateway Communications	LAN Gateway	423
374	Micronet	Micronet	422
147	Nethne	Many Link	455
103	Novell Inc	SFT Netware V2 1	298-299

RS#	ADVERTISER	PRODUCT	PAGE#
722	PCC Systems	CC Mail	324
290	Rose Electronics	Masterswitch	308
191	TOPS	Connectivity	60-61
MICRO-MAINFRAME LINKS			
531	DCA/FOX	IRMA Remote	262-263
532	DCA/FOX	10 NET	286-287
146	Gateway Communications	LAN Gateway	423
MODEMS			
507	Natural Microsystems	Watson	450
231	Touchbase Systems	Modem	310
364	Ven-Tel	Modems	14
EMULATORS/PROTOCOL CONVERTORS			
266	Persoft	Term Emulator Software	243
265	Persoft	IZE-Term, Emulator Software	64
DISKETTES			
267	3M Data Recording Products Div	Magnetic Media	356-357
169	KAO Corporation	Disks	288
INSURANCE			
728	Safeware	Insurance	422
POWER PROTECTION			
140	American Power Conversion Corp	UPS	368
383	Cuesta Systems Corp	Datasaver	323
167	Kensington Microware Ltd	Master Piece, Master Piece Plus	203
381	Para Systems Inc	Minuteman	72
473	PC Cooling Systems	Power Supplies	177
739	Safe Power Systems	Power Supply	346
PC ACCESSORIES			
204	Avery	PC Accessories	416
516	Computer Accessories	PC Accessories	88-89
*	Curbs Manufacturing	PC Accessories	336-338
257	Entre Computer Centers	Computer Centers	217
269	International Battery Corp	Replacement Battery	390
272	Kensington Microware Ltd	PC Accessories	321
473	PC Cooling Systems	Cooling Device	177
TRAINING/SEMINARS			
505	Bantum Books	Book	402
MAIL ORDER			
106	707 Computer Sales	Mail Order	467
521	American Semiconductor	Mail Order	464-465
*	Arlington Computer Products	Mail Order	474-475
*	Bay Express	Mail Order	480
275	Bentley Computers	Compatibles	410-411
125	Boffin Limited	Mail Order	449
481	Bulldog Computer Products	Computer Accessories	432-433
135	Bus Computer Systems	Mail Order	472
320	Compu Add Corp	Compatibles	161
205	Compuclassics	Mail Order	80
109	Computer Discount Warehouse	Mail Order	466
183	Computer Mail Order	Mail Order	408-409
229	Discount Micro Products	Mail Order	204-205
520	Electronic Wholesale House	Mail Order	480
391	F & W Communications	Mail Order	469
352	FASTMICRO	Mail Order	53
266	General Technology Corp	Mail Order	68
382	Intelligent Microsystems	Mail Order	444-445
243	Jade Computer Products	Mail Order	468
346	Jameco Electronics	Mail Order	477
108	JDR Micro Devices	Mail Order	470-471
387	MHI Warehouse	Mail Order	479
*	MICROBEST	Mail Order	462
344	National Computer Ribbons	Computer Ribbons	473
368	Omega Press	Software Mail Order	63
175	On Line Store	Mail Order	482
301	PC Brand	Mail Order	26
310/311	PC Brand	Clone & Software	22-23
*	PC Connection	Mail Order	222-223
535	PC Network (Formerly IMT)	Mail Order	476
255	Pine Computer	Mail Order	482
293	Printers Plus	Mail Order	315
385	S C S	Mail Order	434
184	Shamrock	Mail Order	478
123	Silicon Specialties	Mail Order	81
*	Softline	Mail Order	84
206	Telemart	Mail Order	44-45
512	The Computer Warehouse	Mail Order	479
268	Tussey Computer Products	Mail Order	66-67
171	Warehouse Data Products	Mail Order	90-91
528	Whole Earth Computer	Mail Order	451
ELECTRONIC MAIL			
484	3K USA	Electronic Mail	78
MISCELLANEOUS			
210	Ashton Tate	Developer's Conference	418
149	Bible Research Systems	The Word Processor	481
DIRECT MARKETING CONNECTION			
106	707 Computer Sales	Mail Order	467
521	American Semiconductor	Mail Order	464-465
*	Arlington Computer Products	Mail Order	474-475
*	Bay Express	Mail Order	480
135	Bus Computer Systems	Mail Order	472
109	Computer Discount Warehouse	Mail Order	466
520	Electric Wholesale House	Mail Order	480
391	F & W Communications	Mail Order	469
243	Jade Computer Products	Mail Order	468
346	Jameco Electronics	Mail Order	477
108	JDR Micro Devices	Mail Order	470-471
387	MHI Warehouse	Mail Order	479
*	MICROBEST	Mail Order	462
344	National Computer Ribbons	Printer Ribbons	473
175	On Line Store	Mail Order	480
535	PC Network	Mail Order	476
145	PC Sig	Shareware	463
255	Pine Computer	Mail Order	482
184	Shamrock	Mail Order	478
512	The Computer Warehouse	Mail Order	479

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AFTER HOURS

Genealogy

(continued)

eration chart—complete with birth and death dates and places—on one 8½- by 11-inch page.

The program allows you to design your own number system for continuation charts, a plus any seasoned genealogist will appreciate.

Family Reunion also prints family group sheets on one page and allows names and addresses for two preparers—a nice touch when the preparer uses information for which another actually deserves credit. The female spouse can be put in the top position—the spot usually reserved for the husband. This is very useful for descendants of a single ancestor.

Another nice feature—full address and phone number fields for living relatives—will appeal to family reunion organizers. One of the program modules generates mailing labels straight from the family file.

Last but not least, *Family Reunion* does a nice job of handling multiple databases—an absolute must for a professional genealogist. One of the program modules allows you to switch to a different database without leaving the program.

Family Reunion enjoys an enthusiastic following despite its problems, thanks largely to its elegant printed output and its ability to handle multiple databases with ease.

FAMware should be shipping a faster version of *Family Reunion* by the time this issue hits the newsstands. The new version will be compiled with Microsoft's QuickBASIC 4.0, so the speed increase should be substantial.

List Price: *Family Reunion*, $195.
Requires: 256K RAM, two disk drives, DOS 2.0 or later. Not copy protected. FAMware, 1580 E. Dawn Dr., Salt Lake City, UT 84121; (800) 327-9835.

CIRCLE **648** ON READER SERVICE CARD

Family Roots

Family Roots, from Quinsept, suffers from some of the same problems as *Family Reunion*, but to a lesser degree.

The documentation is bad, but it's sufficient if you're persistent. The program has different modules for each task, but they load much faster than do *Family Reunion*'s. *Family Roots* also insists on a record-number system but, unlike *Family Reunion*, it provides a way to display names opposite record numbers on-screen.

Family Roots takes an odd but quick approach to entering data. Rather than presenting several screens of fields to fill in, the program prompts you to enter as many names as you wish. You then choose an option to begin setting the relationship hooks and filling in biographical information. You can add more names at any time.

Though unusual, this method of adding records seems more natural than trying to fill in all the blanks as you enter a person's data.

Family Roots also streamlines data entry by automating the hooking process a bit more than does *Family Reunion*. For instance, record numbers are needed for hooking, but you can use a name in lieu of a record number temporarily. The program will insert the appropriate record number if you later create a record with that name.

Like *Family Reunion*, *Family Roots* allocates a hefty amount of storage for each record. But, in an innovative touch, *Family Roots* lets you take advantage of the unused space for adding miscellaneous notes or footnotes on family members. *Family Roots* also allows a great deal of flexibility in field entries. You enter as much information as you wish, as long as you don't go beyond the space allocated to that record. Birthplace, for instance, need not be entered in the standard City-County-State format. It could read, "In cab on way to hospital."

You can also print mailing labels from full addresses for living relatives.

Family Roots grudgingly prints standard-format ancestor charts, but it really shines when printing what it calls "free-form" charts. Free-form charts sport the same tree structure as ancestor charts but can show a great deal of information or practically no information for each person. Specifying name only, for instance, generates an extremely compact and convenient version of an ancestor chart.

The program recognizes only one database per installation, a limitation that shouldn't hinder hobbyists but will keep professionals away.

List Price: *Family Roots*, $185.
Requires: 128K RAM, two disk drives (hard disk recommended). DOS 1.1 or later. Not copy protected. Quinsept Inc., P.O. Box 216, Lexington, MA 02173; (800) 637-7668.

CIRCLE **647** ON READER SERVICE CARD

Roots II

Roots II, from Commsoft, deservedly ranks as the top-selling genealogy package. Of the packages that are reviewed here, *Roots II* is the most elegant as well as the most professionally prepared.

The *Roots II* program is made up of one well-written executable file and a handful of overlays, so you don't waste time switching among executable modules.

Most important, the program avoids the use of numbers to identify records. Instead, *Roots* combines a nice range of speedy, on-screen searches with the ability to pick records from the screen.

You store up to 40 names at any time into a fetch table, part of which is always displayed at the bottom of the screen. You pick names from the table as you need them—to specify hooks, subjects of ancestor charts, and so on.

Roots II gives up a bit of the flexibility of the other two programs. Whereas the others let you establish parent and child hooks in each record, *Roots* allows only hooks to parents to be set from any record. And, since hooks are made by choosing from the fetch table, you'll have to leave the parent fields temporarily blank if you haven't entered records for the subject's parents.

Genealogy: Tapping the On-line Source

With modems becoming more common among all classes of PC users, genealogists are beginning to turn to several on-line services that are dedicated to putting genealogists in touch with each other.

Two such services—GEnie's Genealogy RoundTable and CompuServe's Roots forum—offer not only areas where users post queries for information on certain family lines, but also on-line chatting, software free for the downloading, and useful bulletins concerning genealogy and genealogy societies.

Another service, the National Genealogy Conference, comprises an ever-growing number of local bulletin boards joined into a nationwide network, and it carries no usage fee. As in the aforementioned services, users are encouraged to leave queries and also to help other users when able.

At last count, over 100 local bulletin boards had joined in the fun, and the list is growing rapidly.

Commsoft began the NGC after starting its own BBS. To find the number for the local NGC-participating BBS nearest you, call the Commsoft BBS at (415) 967-6730 and download GBBS.TXT. **—Mitt Jones**

This can lead to substantial frustration if you're entering large lists of names. The program's speed and otherwise thoughtful design more than make up for this frustration, however.

For instance, nine flags attached to each record let you encode information of your own choosing into files. Flags or combinations of flags can be used to indicate information such as fraternal affiliations, hair color, cause of death, and the like.

A slew of error checks also aids in the data entry process. It "tsk-tsks" about "preemie" firstborn children—a cute way of telling you to check your marriage and birth dates—and points out ancestors who appear to have lived 147 years. *Roots II* also reuses names and locations, saving both disk storage and entry time. Once you've entered "Lyme New London CT," for instance, the program will automatically enter the entire line when you type "Ly" on subsequent entries.

Roots II also provides an abundance of on-screen capabilities that make maintaining and using the data much easier.

Searches by name, date, location, or certain flags yield on-screen lists in a flash. You can then add any of the subjects to the fetch table by pointing to the subject and hitting a key combination.

Excellent on-screen ancestor charts let you run up or down family lines, a big help in avoiding generation gaps. You can also run up and down miniature family group sheets on the screen to check connections.

Roots II will even calculate blood relationships between any two subjects, by either canon or civil law.

Roots does a nice job of compressing data files, allowing several thousand records to be stored on one floppy disk. It can also handle multiple databases, though you must exit the program to change your database. The program's printed reports include everything you'd expect and then some. The family group sheet has loads of information on each person. Each group sheet stretches over several pages. Footnotes are available for referencing and documenting information.

Extremely clear ancestral charts detail five generations and include the spouse of the initial entry. The program automatically numbers and references continuation charts. Ahnentafel charts are surprisingly easy to read.

Family genealogists and historians who intend to publish their findings will like this program. It has the capability to produce camera-ready copy, including text produced on a word processor and linked to appropriate charts. Page numbers can be alternated for back-to-back printing, and you can index the entire print job.

Roots II wins hands down for ease of use and intelligent design. By the time this issue goes to press, *Roots III* should be available. Commsoft was unable to ship the newest version to us in time for inclusion in this review. But if *Roots II* is any indication, *Roots III* should be a winner.

List Price: *Roots II*, $195. **Requires:** 64K RAM (320K recommended), DOS 1.1 or later. Not copy protected. Commsoft, 2257 Old Middlefield Way, Mountain View, CA 94043; (800) 327-6687.

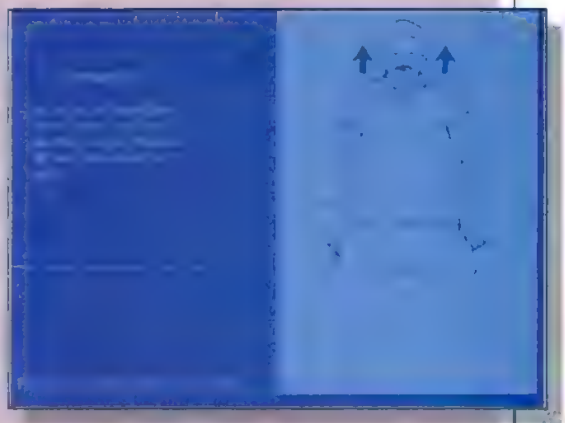
CIRCLE **646** ON READER SERVICE CARD

FITNESS

Stretch Away Your Stress with Pop-up Exercise

BY JENNIFER ZAINO

Your eyes fastened on the screen, you heed the commands to stretch out those hip, back, and neck muscles. Though this may sound like a scene from your favorite video workout, there's no Jane Fonda, Richard Simmons, or VCR in sight.



The on-screen text instructions in Computer Stretches tell you how to move your body into stretching position. The dots in the drawing designate the areas where the stretch should be felt.

Instead, you're stretching to the beat of *Bob and Jean Anderson's Computer Stretches*, a memory-resident pop-up program from FB Systems that graphically depicts 14 stretching routines. The exercises are designed to relieve the stress, muscular tension, and pain that can result from sitting for many hours in front of your computer terminal. The $49.95 program is based on Bob Anderson's *Stretching* book ($9.95 from Shelter Publications, Bolinas, California).

You can keep to a daily stretching regimen by defining up to four timers that start *Computer Stretches* automatically throughout the day. If it pops up at an inconvenient time, you can select the Quit option and you'll be bounced right back to your application.

You have the option of choosing A-, B-, or C-level stretches. As you move to the more-advanced levels, more stretches are added, and the amount of time allocated for some of the stretches increases. A beep, which you can turn off, signals when the stretches will begin and end.

Even in EGA mode, *Computer Stretches*' graphics are static and bland. A program of this type could really benefit from even minimal animation to illustrate how to move your body into stretching position. Instead, you have to rely on the manual or the on-screen text instructions to learn how to maneuver your body into the proper position. The parts of the body where the stretch should be felt are marked off with dots in the drawings.

Though *Computer Stretches* did not have any conflicts with memory-resident programs like *SideKick* and *Tornado Notes*, we found that it did cause *XyWrite* to malfunction on three different machines. The company was unable to provide a solution to this problem.

Stretching at regular intervals undoubtedly relieves the strains and pains associated with computer work. And *Computer Stretches*' handy user-definable timers make it a valuable program for those who need to be prompted to keep to a daily stretching routine. However, the program's amateur graphics show that FB Systems settled for something less than a high-energy, high-impact stretching session.

List Price: *Bob and Jean Anderson's Computer Stretches*, $49.95. **Requires:** 256K RAM, hard disk, graphics adapter, DOS 2.0 or later. Not copy protected. FB Systems Inc., 23524 St. Andrews Ct., Auburn, CA 95603; (916) 268-1122.

CIRCLE **645** ON READER SERVICE CARD

AFTER HOURS

GENEALOGY

Exploring Your Roots With PC-Based Genealogy Software Programs

BY DIANA ISENRING AND MITT JONES

Whether you're looking for a sense of place in the world or a legacy of fame, chances are you've at least thought about taking the plunge into genealogy. It's unlikely your search will turn up a claim to the Hughes estate, but a well-done search will undoubtedly turn up enough interesting ancestors to make the effort worthwhile.

Genealogy programs are essentially highly specialized database management programs. Unlike your typical database, however, each record in a genealogical database is "hooked" to at least one other record and often many. For instance, a record for a mother of seven children requires hooks not only to the records of her seven children but also to those of her husband and parents.

This highly specialized and intricate structure makes genealogy packages somewhat more complex than a typical database program. It also creates concerns for users of these programs. Setting the hooks, or relationships, among family members can become somewhat of a chore. How each program handles data entry, record searches, and hooks becomes extremely important.

The other major area of concern when shopping for a genealogy package should be the range and quality of the reports the package generates, since good-looking output is probably what you're after in the first place.

Genealogists typically depend on three forms of charts. The ancestor or pedigree chart is what laymen call a family tree. An ahnentafel chart compresses the information in an ancestor chart by removing the branches, making it tough to read but mercifully compact. Finally, a family group sheet shows only the members of one nuclear family—mother, father, and their offspring.

With these features in mind, we rounded up three of the more-powerful and commonly used genealogy packages for the PC. Each package takes a different approach to entering and maintaining the data. Each also offers a feature or two that the other programs don't.

Family Reunion

Family Reunion, from FAMware, offers a handful of useful features, but the program is difficult to install and even more difficult to learn, owing in part to the poor quality of its documentation.

The program's slowness ranks among its biggest problems. Written in BASICA and compiled with IBM's BASIC Compiler, it comprises some 24 separate routines you access via a central menu. Count patience among your virtues if you're not beating your keyboard by the time the program moves from one module to another.

For instance, exiting from the Data Entry module to the main menu took about 15 seconds on my XT compatible. Moving into the Pedigree Print module from there took another 15 seconds.

The program's number-oriented record scheme also contributes to the frustration. All modules make you specify record ID numbers for the records you wish to access or search.

To add insult to injury, you can't even browse through the records that are on the screen to find the ID number for the record you're hunting. Instead, *Family Reunion* allows you to print only an alphabetized index that matches ID number to name. It's a workable but nonetheless irksome solution.

You set relationship hooks when adding or editing an entry by inserting record numbers in the appropriate field. The data entry screen lists several offspring fields for each person, for instance. You enter the record ID for each child into one of the fields. Again, this requires that you know the record number instead of the name.

Mercifully, once you put a child in a parent's record, the program will automatically put the parent's record in the child's.

When you add a record, the program takes you through several screens packed with a variety of fields.

This seems at first to be an advantage, since you're likely to find all the fields you need. Whether used or not, however, these fields occupy precious space on your disk. For large databases, the program's space-hogging nature could definitely be a problem.

On the upside, *Family Reunion* produces one of the most elegant computerized six-generation ancestor charts you'll find anywhere. We were able to print a fairly complete six-gen-

(continues)

Up to 40 names at a time can be stored in the Roots II *fetch table, which is always displayed at the bottom of the screen. You can easily pick names from the table as you need them.*

PAF Puts You in Touch with Your Roots

No roundup of genealogy packages would be complete without at least a mention of *Personal Ancestry File* (see After Hours, *PC Magazine*, December 8, 1987). *PAF*, as the program is known in genealogy circles, is a basic but excellent genealogy program designed and sold by the Church of Jesus Christ of Latter-day Saints.

With an estimated 40,000 users, the program boasts the largest user base of any genealogy package for the PC. That's partly because of its price—only $35—but also because of its competence.

PAF won't wow you with a mélange of eye-popping features or fancy output, but it handles basic text entry and output quite nicely.

Should you outgrow its capabilities somewhere down the road, you'll be able to export your data to *Roots II* or *Family Roots* with little trouble. Each offers, at little or no charge, a utility that translates *PAF* files into its own format.

To obtain a copy of *PAF*, call or write: Distribution Center, 1999 W. 1700, South Salt Lake City, UT 84104; (800) 247-3892, ext. 5274; (801) 531-2584. **—Mitt Jones**

INDEX TO ADVERTISERS

RS #	ADVERTISERS	PAGE
267	3M	356-357
484	3X USA	78
106	707 Sales	467
128	Aldus Corp.	198-201
345	Alloy Computer	202
242	Alps America	282-283
140	American Power Conversion	368
521	American Semi Conductor	464-465
475	American Small Business	353
185	Aptech	293
111	Arche Technologies	206
527	Archive	314
*	Arlington Computer Products	474-475
324	Ashton-Tate	344-345
210	Ashton-Tate	418
519	Ashton-Tate	376-377
471	askSam Systems	86
230	ASP Computer Products	406
166	AST Research	415
540	ATI Technologies	281
165	Autodesk	313
204	Avery	416
395	Axon	329
505	Bantum Books	402
*	Bay Express	480
172	Bay Technical Associates	178
482	Bedford Software	320
275	Bently Computer	410-411
149	Bible Research	481
218	Bitstream	257
116	Blaise Computer	392
125	Boffin Limited	449
377	Borland	57
137	Borland	55
138	Borland	C2-4
*	Borland	1
296	BSI	420
328	Buffalo Products	429
481	Bulldog Computer	432-433
135	Bus Computer	472
494	ButtonWare Inc.	439
160	Central Point	74
120	Central Point	75
318	Chinon	191
114	Citizen America	2-3
134	Clarion Software	70
188	Command Technology	428
261	Compact Disc Products	308
279	CompuAdd Corp.	166
320	CompuAdd Corp	181
294	CompuAdd Corp	162-165
*	CompuAdd Corp	163-164
205	Compuclassics	80
516	Computer Accessories	88-89
281	Computer Associates	401
109	Computer Discount Warehouse	466
130	Computer Ease Software	316
183	Computer Mail Order	408-409
163	Computer Products United	174-175
225	Core International	261
292	Corporate Software	319
194	Cougar Mountain	371
360	Crescent Software	443
326	Crosstalk	152-153
276	Crosstalk	76
383	Cuesta Systems	323
*	Curtis	336-338
220	DAC Software	69
247	Data Copy	245
504	Datastorm Tech	139
152	Data Technology	355
313	Datavue	399
*	Data World	426
148	dBFast	307
532	DCA/Fox	286-287
531	DCA/Fox	262-263
536	Dell Computer	114-115
539	Dell Computer	112-113
241	Diconix	270-271
229	Discount Micro Products	204-205
330	Dynamic Microprocessor	389
520	Electronic Wholesale	480
257	Entre Computer	217
170	Equinox Systems	456
216	Everex Systems	274-275
159	Everex systems	184
525	Excelitech Inc.	448
352	FASTMICRO	53
386	FiveStar Computer	458-459
174	Form Worx Inc.	101
112	Fox Software	87
323	Funk Software	82-83
391	F & W Communications	469
146	Gateway Communications	423
740	GE Computer Service	417
522	GeneLogic Systems	451
266	General Technology	68
506	Generic Software	378
239	Genoa Systems	382
369	Golden Bow Systems	4
502	Group L	326
380	Hammerly Computer	335
276	Hauppauge Computer	32
201	Haventree S.W.	438
136	Hayes Microcomputer	372
357	Hewlett-Packard	104-105
339	Hewlett-Packard	388
124	Hyundai	454
*	IBM Corp.	396
265	IDE Associates	136-137
499	IMSI	29
*	Informix Software	180-183
496	Insignia Solutions	407
200	Intergrated Information Systems	21
382	Intelligent Micro Systems	444-445
269	International Battery	390
*	Intuit Software	231
378	Iomega	360
219	Irwin Magnetics	248-249
243	Jade Computer	468
346	Jameco	477
108	JDR	470-471
169	KAO	288
343	KayPro	333
167	Kensington Microware	203
272	Kensington Microware	321
193	Kinson Products	124
341	Lifetime Memory	457
133	Logitech	188-189
182	Logitech	215
*	Lotus	119
*	Lotus	121
*	Lotus	149
*	Lotus	157
*	Lotus	159
*	Lotus	225
*	Lotus	227
*	Lotus	247
263	Macola Inc.	442
101	Magnavox	110
224	Mannesmann Tally	194
154	Mathsoft Inc.	305
102	May Computer	197
495	Maynard Electronics	430
228	Meridan Technology	133
387	MHI	478
*	MICROBEST	462
302	MicroCom Systems	16
*	Micrografx	92
*	MicroLogic Corp.	347
526	Microlytics	185
374	Micronet	422
240	MicroPro	258-259
176	Microrim	424-425
*	Microsoft	C8
*	Microsoft	C5-7
*	Microsoft	327
331	Microway	334
371	Mitsubishi	364-365
350	Mouse Systems	297
373	Mutoh America	285
344	National Computer	473
507	Natural Microsystem	450
131	NEC Home Electronics	122-123
115	NEC Home Electronics	240-241
147	Netline	455
*	Northgate Computer	404-405
*	Northgate Computer	452
217	Norton-Lambert	20
103	Novell Inc.	298-299
235	Okidata	311
368	Omega Press	63
175	On-Line	482
*	Oracle	47
129	Output Technology	322
119	Panasonic	387
381	Para System	72
359	Paradise Systems	125
211	Paul Mace Software	309
310	PC Brand	22
311	PC Brand	23
308	PC Brand	24
309	PC Brand	25
301	PC Brand	26
303	PC Brand	30
304	PC Brand	31
*	PC Connection	220-223
473	PC Cooling	177
372	PC Designs	421
535	PC Network	476
145	PC Sig	463
722	PCC Systems	324
358	Peachtree Software	330
366	Persoft	243
365	Persoft	64
489	Personal Computer Support Group	10
483	Personal Computer Support Group	11-13
282	Personics	17
*	Personics	406
255	Pine Computer	482
164	Plus Development	294-295
209	Princeton	126
293	Printers Plus	315
529	Public Software Library, The	392
384	Qandu Computing	250
189	Quadram	359
*	Quaid Software	304
474	Quarter Deck	99
256	Relay Communications	144-146
348	Research Development	350
327	Revelation Technologies	412
749	Ricoh	211
479	Rightsoft	37
290	Rose Electronics	308
739	Safepower Systems	345
728	Safeware	422
298	Samsung Corp.	446
245	Santa Cruz Operation Inc.	365
470	SBT	18-19
385	S.C.S.	434
184	Shamrock	478
252	Sigma Designs	441
123	Silicon Specialties	81
478	Softklone	328
*	Softline	84
334	Softlogic Solutions	39
*	Softlogic Solutions	168
726	Software Excitement	318
487	Software Masters	304
488	Software Masters	317
*	Software Publishing	264-265
234	Software Spectrum	391
271	Sony Corp.	193
390	Spield Computer	50
319	Sterling Castle	341
*	Sun Microsystems	169
254	Sun Microsystems	170-171
299	Swfte International	109
745	Symantec	45
250	Symantec	58
249	Symantec/Breakthrough	42
173	Sysgen Inc.	218
233	Tallgrass Technologies	306
232	Tandon	362-363
206	Telemart	44-45
512	The Computer Warehouse	479
259	The Laser Connection	5
363	The Software Group	186
393	The Software Link	212-213
191	TOPS	60-61
*	Toshiba	236-237
*	Toshiba	385
231	Touchbase Systems	310
*	Transec Systems	437
222	Traveling Software	325
150	Truevision Inc.	173
268	Tussey Computer	66-67
364	Ven-Tel	14
329	Vertex Systems	233
127	Video-7 Inc.	393
171	Warehouse Data	90-91
485	Westlake Data	312
312	White Crane Systems	28
528	Whole Earth Computer	451
513	Wordperfect Corp.	348-349
508	Wordperfect Corp.	395
734	WYSE Technology	229
518	Xyquest	134
337	Zenith Data Systems	155
325	Zenographics	9
723	Zeos International	79
721	Zeos International	234
316	ZyLAB Corp.	431

*—No Reader Service #. Please call advertiser for information.

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GAMES

Hit the Hustings, Shake Some Hands, And You Could Be President

BY STEPHANIE IZAREK

If you think Gary Hart had a scandalous campaign, wait until you enter *your* bid for the presidency in Front Runner Software's new presidential election game, *Campaign Promises*. Tangled affairs, widespread rumors, bribery, sex scandals, and so-called mishaps run rampant in this game, just as they do in a real presidential election.

Test your political prowess and strategic planning against your friends in an exciting race for the ultimate title, the height of bosshood—the presidency. By winning the most electoral votes in each state and by showing no mercy, you will be well on your way to the White House.

There are a total of 538 electoral votes in 51 possible elections. Each of the 51 elections is called separately, and the electoral votes per state equal the number of congressional representatives plus the number of senators. Like a real presidential election, a simple majority is all that is required to win.

The individual elections are won by the Popular vote, which is the summation of the results of the following Vote categories: Campaign Promise Votes, Campaign Organization Votes, Advertising Votes, and Just Plain Luck Votes.

By using the colorful main menu, you strategically select your priority areas. Because Promise Votes often win elections, it is important to have an abundance. You begin the game with three initial promises, chosen from a list of 20, that represent your main concerns and, hopefully, those of the voters. During each election, three promises are randomly chosen by the computer to represent the voters' concerns and are then compared with yours. The matches increase the potential Promise Votes you can earn.

By using the Buy Promises option or by landing on the Promise location during your campaign turn, promises can be purchased at a price randomly selected by the computer, ranging from $5,000 to $50,000.

Don't get sidetracked and spend all of your funds on promises. You'll need your funds to gain votes in the other important categories. You need to set up Organizations in each state to generate more funds. The earlier you establish them, the longer they exist and, therefore, accumulate more money and votes.

Similarly, your Advertising Campaign requires money. Unfortunately, the general rule here is that whoever spends the most money in advertising wins the most Advertising Votes. (Sounds true to life, doesn't it?)

It's important to be frugal with your funds, because if you end up with a negative balance, you will be ineligible to hold an election in the state of your choice.

Basically, the name of the game is to have a well-thought-out strategy, use your wit, and *always* pay attention to the campaign moves the other candidates are making. In political warfare no one can be trusted—especially since *Campaign Promises* includes a nasty option called Dirty Tricks. For a cost, randomly determined, of between $5,000 and $25,000, you can sabotage an opponent's campaign. You can inform the press of unethical contributions, gift improprieties, or marital problems. Or how about having your opponent lose his hairpiece during a key speech? The dirty tricks are handled covertly by your campaign staff and can pop up at any time during the candidate's turn.

Campaign Promises is an exciting and competitive game that displays colorful screens and an easy-to-use menu. You are also provided with an on-screen tutorial and a well-organized manual.

The screen constantly displays flashing words and prompts that can be distracting and annoying. Front Runner also claims that *Campaign Promises* will work effectively on monochrome monitors. This is only partially true. The game will run on a monochrome monitor, but the states and the location board are all color coded. Unless you sit down and memorize the coding system or constantly refer to the coding system, the game will become confusing.

Overall, Front Runner incorporates the major concepts of a presidential election and the opportunity to see how deceitful you can be in a creative and challenging game. So, if you think that your campaigning skills are first-rate and that you can do it better than Ronnie, *Campaign Promises* gives you the chance to prove it.

List Price: *Campaign Promises*, $32.95. **Requires:** 256K RAM, CGA or EGA, DOS 2.0 or later. Not copy protected. Front Runner Software, P.O. Box 435, Collinsville, CT 06022; (203) 233-3144.

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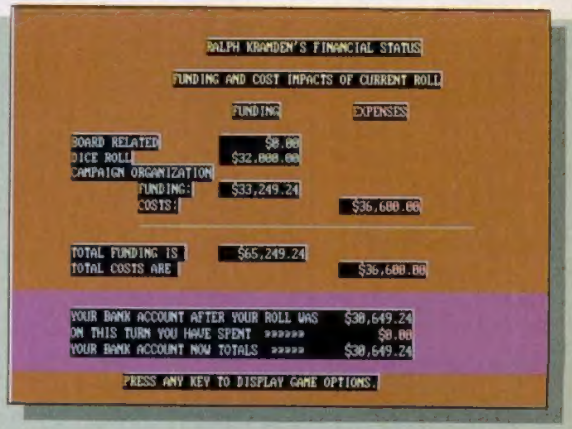

Ralph Kramden for President? As long as he's got enough money to launch successful advertising campaigns, he could win the election in Campaign Promises.

AFTER HOURS INDEX

Family Reunion, Family Roots, Roots II
Three programs to track your ancestry and create printed family trees. Plus: on-line genealogy bulletin boards help you swap family info

Computer Stretches
Stretch those muscles with a memory-resident exercise program

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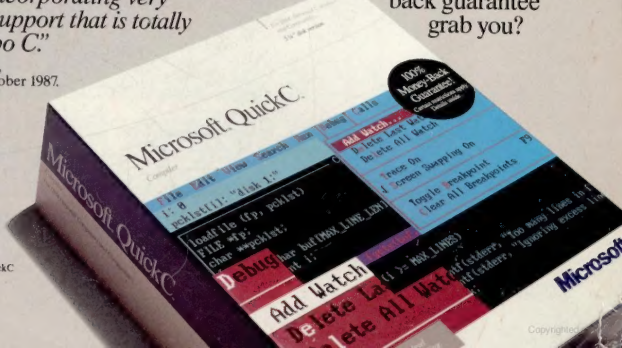

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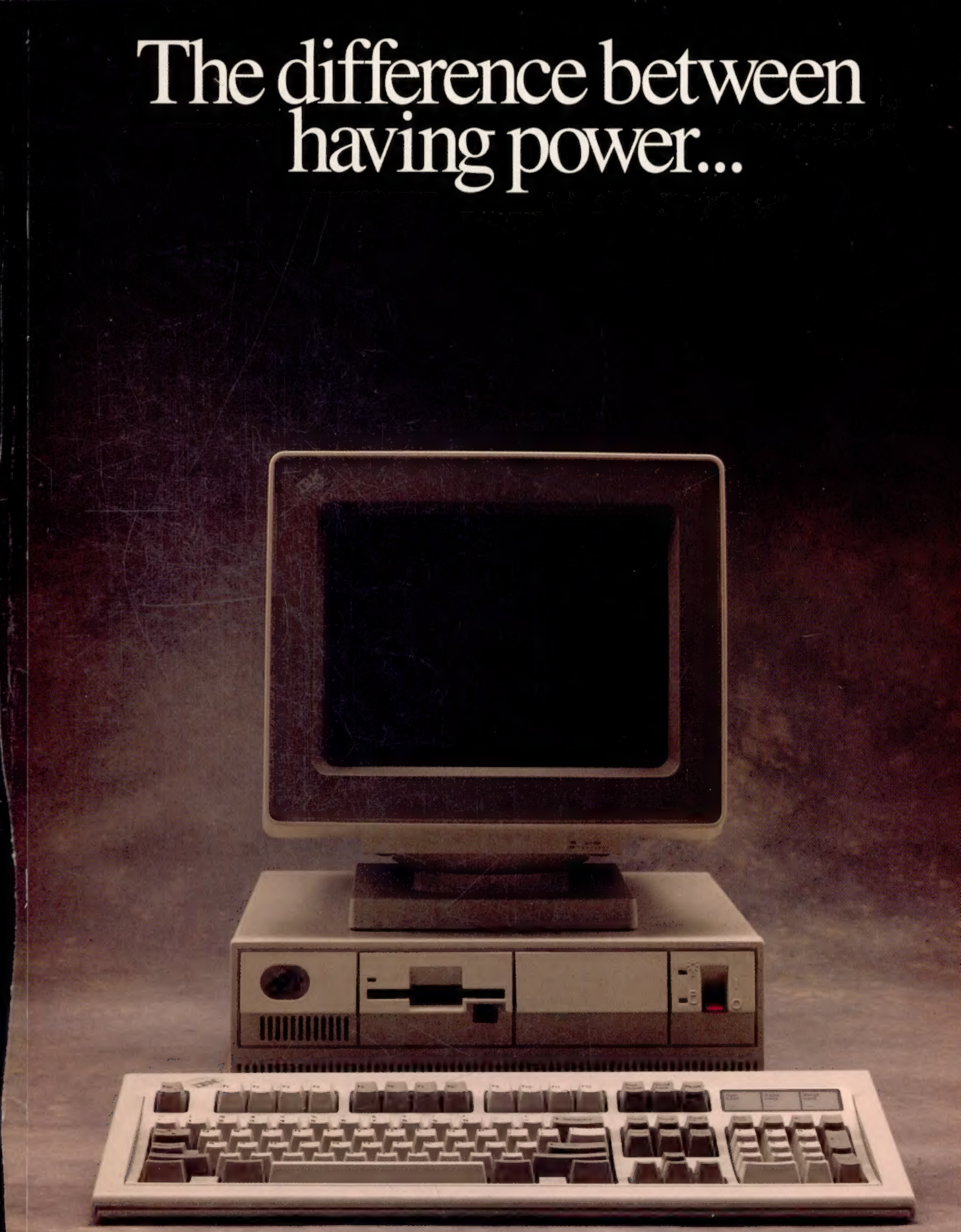
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